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Advertisement Index, see page xxviii.

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Vol. LXXXI.] CONTENTS: October 26, 1917. [No. 2,083.

	Page
An Institute for Discoveries and Inventions	385
The Gas-driven Car	386
The Lumen	386
The Fixation of Atmospheric Nitrogen (*concluded*)	387
Inductive and Electrostatic Troubles arising from A.C. Railways	388
Magneto Flash Lamps (*illus.*)	390
Electrical Work at the Physikalisch-Technische Reichsanstalt, Charlottenburg, in 1916	391
The Working Costs of the Principal Prime Movers, by O. Wans (*illus.*)	391
Federation of British Industries	393
War Items	394
Correspondence—	
The E.T.U. and the A.E.S.E....	395
The Association Movement	395
The Niche and its Occupant...	396
Legal	396
Business Notes	397
Notes	400
City Notes	402
Stocks and Shares	403
Market Quotations	404
The High-Tension Magneto (*continued*)...	405
British and American Electrical Trade with Australia ...	406
New Electrical Devices, Fittings and Plant (*illus.*)	407
Foreign and Colonial Tariffs on Electrical Goods	408
New Patents Applied for, 1917	408
Abstracts of Published Specifications	408
Contractors' Column ... ... Advertisement page xxii	

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AN INSTITUTE FOR DISCOVERIES AND INVENTIONS.

"THE ideas of inventors," says *E.T.Z.*, "represent not the least interest on the capital formed by a people's spirit of enterprise, and an Institute for Discoveries and Inventions is an economic necessity." During the war, all the principal countries concerned have arranged to make full use of ideas submitted to a central committee, and to analyse and develop these, however unpromising they may appear in their original forms. What is needed is a permanent organisation to render similar service to the nation after the war. The raw materials section of the German War Ministry has been established as a permanent authority, and therein *E.T.Z.* sees the modest beginnings of an "Economic General Staff," which will organise and control a comprehensive scheme of economic mobilisation.

The Kaiser Wilhelm Gesellschaft, the Materialprufungsamt (for testing materials), and the research departments of colleges and large firms are milestones on the path of technical progress. The Jubilee Foundation of German industry and the Bach Foundation for technical and scientific research are only a couple of examples of the rich resources available. The standing committee of the German Union for developing foreign trade, and securing the interests of industry and commerce in the central administration of Germany, deals with concurrent problems. A promising commencement in the utilisation of experience, ideas, and observations is to be seen in the fact that the staff of the War Department is acting as an exchange, and that the chairman of the German Union of Technical and Scientific Associations has arranged for interchange of views and requirements between industrial technical interests, and the scientific laboratories of the colleges.

The basis of the proposed *Erfindungsinstitut* includes statutory organisation and the support of the principal professional institutions. Ideas and proposals submitted to the new Institute would be examined carefully, developed as far as possible in laboratories (new or existing), and then distributed to and utilised by the industries concerned. A due proportion of net profit would be reserved to the original inventor. The end in view is intelligent fusion on a broad social basis of the functions of private concerns for developing patents, and the ideals of a State department serving the common weal.

What has already been done along these lines in this country is known to our readers so far as it is wise to publish details during the war. There is still room for further advance and improvement, but we have already done much in the way of Imperialising raw materials and developing industrial research and manufacture. Such movements have been prosecuted at least as vigorously in our Oversea Dominions as at home. The achievements of peaceful industrial research in the U.S.A. have been worthily continued and extended in the war organisation of that country. Committees for war industry did sterling service in sifting and developing inventions in Petrograd and Moscow before the revolution, and it is to be hoped that their activities will be extended further during the war, and continued thereafter to the benefit of Russian industrial and economic development.

A Commission of the Académie des Sciences is agitating for the immediate establishment of a

national laboratory of physics and mechanics to serve home industries by research work and by developing inventions. Finland, Sweden, and Switzerland are displaying similar activity and enterprise; and for the same general purposes Japan has founded the Rikagaku Kenkyusho Institute with £196,000 capital and an annual State subsidy of £2,450. In Vienna the Technical Research Department is working with good results, and there are "a number of new, specifically Austrian organisations" as well.

Germany reckons upon "the sort of Chinese Wall, which has been placed round all the great Powers by the war, being dissolved by the resumption of international traffic after peace is declared. Wise domestic transition policy will prepare for this change. Commercial treaties, patent laws, and economic measures will need reconstructing, and the spirit of invention must be kept mobile." An institute for discoveries and inventions should certainly be regarded as an economic necessity by every great Power from now onwards, but, as for the rest, the deeds and lessons of the war cannot lightly be forgotten, and Germany is likely to find that the Allies' Wall is long, high, and durable.

The Gas-driven Car.

The recent demonstration, in London, of motor vehicles equipped for operation on coal gas is a striking tribute to the efficacy of a little vigorous pushing of even an undesirable thing. There were present, according to the *Westminster Gazette*, "motor cycles with canopy-like tops filled with domestic gas, a lorry for heavy haulage whose overhead envelope took the form of a miniature Zeppelin, and a private motor car whose seven-shillings' worth of gas was carried separately in a bulky container on a special trailer hooked on to the rear of the vehicle; a converted eight-seater Ford carried its charge of gas compressed in cylinders on the side running boards, while to a lordly landaulette was tacked on a single-wheel auto-trailer with a nest of gas cylinders." Needless to add, these excrescences have come about solely owing to the shortage of motor spirit and the dire necessity for finding some substitute fuel for internal-combustion engined cars. But, though we regard the coal-gas driven car and its attendant paraphernalia as a makeshift, it is evident that some motoring circles attach considerable importance to future possibilities in this direction, no doubt having in mind a probable shortage of liquid fuel for some years to come, and it is, therefore, of interest to examine the present possibilities of this development, which has received the blessing of certain motoring contemporaries, who, incidentally, have in the past extended a none too friendly hand to the battery-driven vehicle.

From published data it would appear that a gas-bag capacity of 450 to 500 cu. ft. is the practical limit for vehicles of the 'bus type, and this represents about 14 miles running, while a taxi-cab is assumed to carry 120 cu. ft. and travel 10 miles, so that liberal gas-charging facilities would be a *sine qua non*. There is the alternative of using compressed gas, though the stability of coal-gas under considerable pressure has to be considered, and steel containers are both weighty and expensive, even if obtainable, while an experimental rubber container measuring 4 ft. 6 in. by 1 ft. 3 in., for 1,800 lb. pressure, contains only a normal 500 cu. ft. of gas, equivalent to, say, from 14 to 40 miles' running on the basis already mentioned. Moreover, unless the car engine can be adapted to work a compressor, independent charging apparatus would be required, considerable expense being involved either way.

We have laid stress on the limited mileages which attach to the use of coal gas for vehicle propulsion, because it is precisely on this point that our motoring contemporaries have in the past condemned the electric vehicle—which, whatever its limitations, has never suffered from such a severe mileage handicap as the coal-gas driven vehicle apparently will. The electric vehicle with a normal commercial range of 40 to 60 miles on one charge, and the proved capability of increasing this distance to 100 miles without introducing abnormal constructional features, not to mention its use of still cheaper fuel—roughly one-third cheaper, is obviously far ahead of the new "hybrid" which our motoring friends are so assiduously cultivating.

Mechanical traction is an indispensable factor of the present day, but, under existing conditions, the petrol engine is a millstone round the necks of those who depend on spirituous fuel, and if they use gas in its stead it is a case of "needs must when the devil drives."

The Lumen.

Although the term "Lumen" has been adopted by the leading manufacturers of Great Britain—as well as of the United States and Canada—for rating the luminous output of a lamp, in place of the candle-power (which, in point of fact, in no way measures the output), like all such innovations, it may present some difficulties to those who are not familiar with its nature and origin. It may be helpful to electrical readers to point out the analogy which exists between it and the flux from a magnetic pole.

The intensity of the magnetic field near the pole of a long straight magnet of given strength varies in magnitude inversely as the square of the distance from the pole, and the direction of the magnetic force varies from point to point; similarly, the intensity of illumination due to a lamp of given candle-power varies inversely as the square of the distance from the lamp, and the direction of the light-rays varies from point to point. But in most practical applications of magnets, it is not the intensity of the field or the direction of the force that is of importance—the quantity which it is usually necessary to know is the total magnetic flux proceeding from the pole in whatever direction, and this is equal to the strength of pole multiplied by 4π. In the same way, the important quantity in the case of a lamp is not its candle-power in a given direction, but the total amount of light which it produces; and this is similarly obtained by multiplying the mean value of the candle-power in all directions (*i.e.*, the mean spherical candle-power) by 4π. The result in the former case is the number of lines of force proceeding from the magnet pole; in the latter, the number of lumens generated by the lamp. The dynamo designer has no use for the "strength of pole" in his machines; he never gives it a thought—and, similarly, the illuminating engineer is not concerned with the candle-power of the lamps that he uses. What he wants to know is *how much light* a lamp gives out; the candle-power is no guide to this quantity, but the rating in lumens gives it to him at once, and without any calculation or guess-work.

In the same way, the old expression "watts per candle" was an illusory means of expressing the efficiency (or, more correctly, the "inefficiency") of a lamp, depending as it did upon the type of lamp and the mode of measurement; the rating in "lumens per watt," on the other hand, is a true criterion of efficiency, and is independent of the method of measurement. The lumen is the amount of light which will illuminate 1 sq. ft. of surface to the intensity of 1 ft.-candle; knowing the area to be illuminated, and the intensity of illumination desired, the number of lumens required, and hence the number of lamps of a given pattern, is at once obtained in the simplest possible way—namely, by multiplying the two factors together.

THE FIXATION OF ATMOSPHERIC NITROGEN.

(*Concluded from page* 365.)

Processes and Policies.—Florentin summarises the relative costs and merits of fixation processes at present in industrial use, as follows:—Arc oxidisation processes yield nitric acid directly, but their overall efficiency is low (1 KW.-year yielding only 1,100 lb. of nitric acid, corresponding to 244 lb. of fixed nitrogen). This limits their commercial application to sites where there is cheap and abundant water power. The Haber process is far more efficient, and is therefore suitable for any country (*e.g.*, England and Germany), where there is little or no cheap water power. Producer gas from waste coal or lignite yields cheap current for driving the gas compressors (say, 0·2d. per unit down to 64s. per KW.-year). The cyanamide process yields 990 lb. of fixed nitrogen per KW.-year, more than four times the yield of the arc process, but still requiring cheap power in order to compete with the Haber process. The Serpek process yields pure alumina and ammonia, both useful products; the energy consumption is low, and only partially chargeable to the ammonia, but the process must be used to a greater extent before its merits can be assessed definitely.

The energy consumption per lb. of nitrogen fixed by various processes averages as follows (Kroczek):—

	KW.-hour per lb.	H.P.-hour per lb.
Kowalsky-Pauling	32·5	43·5
Birkeland-Eyde	28·3	38·0
Schönherr	27·0	36·0
Calcium cyanamide	11·0	14·7
Serpek (Kroczek)	5·5	7·3
„ (Florentin)	7·3	9·8
Haber	?	?

On a pre-war basis, the price per lb. of nitrogen in various compounds was:— Sodium nitrate, 6·3d.; ammonium sulphate and calcium nitrate, 6·5d.; calcium cyanamide, 5·6d. These figures are only comparative.

In Germany three fixation processes (arc oxidisation, synthesis of ammonia, and cyanamide) are in competition, and the ton of ammonium sulphate costs about £6 2s. by the Haber process and £6 9s. from cyanamide, corresponding to 3¼d. and 3½d. per lb. of nitrogen. However, in 1916, the Bundesrath fixed the maximum price for nitrogen at 7·85d. per lb.; and the price of nitrogen in France was 7·55d. per lb. as nitrate and 7·35d. per lb. as ammonium sulphate in 1913, corresponding figures for 1916 being 11·65d. and 11·2d. per lb. of nitrogen. Whatever the German costs may be, there is no doubt that the B.A.S.F. (operating the Haber process) counts on meeting successfully any home or foreign competition, and is, therefore, opposed to the "nitrogen monopoly" proposed by the cyanamide groups, who feel less sure of their ability to compete with Chilean and Norwegian nitrates.

The Haber process is almost certainly the most efficient, and it furnishes very pure ammonia, which is easily and efficiently converted to nitric acid or nitrate. On the other hand, arc processes, the cyanamide process, and the Serpek process use simpler equipment, need much less skilled supervision, and can compete with the Haber process where energy is cheap.

Reduced to a nitrogen basis, the world's production in 1913 and 1915 was approximately as follows:—

	1913. Tons of nitrogen.	1913. Per cent. of total.	1915. Tons of nitrogen.	1915. Per cent. of total.
Arc oxidisation process ...	16,915	20·2	27,570	10
Haber process	7,300	8·7	54,430	20
Cyanamide process ...	59,490	71·1	190,000	70
	83,705		272,000	

The 1916 output by the Haber and cyanamide processes was, doubtless, much greater, and the total output much above 300,000 tons of nitrogen, *i.e.*, equal to, or more, than the equivalent of the whole Chile nitrate output for the year.

American Views and Estimates.—Valuable data concerning production costs and pertinent suggestions as to the best method of developing a synthetic nitrate industry are given by Dr. T. H. Norton* in discussing American sources and consumption of nitrates and the effective application of the £4,000,000 appropriation made by Congress in 1916 for the construction and organisation of Government works for producing nitrogen compounds suitable for military and general economic needs. Norton considers three main sources of combined nitrogen, viz., Chile nitrate, ammonia, and nitric acid. In 1908, America consumed 325,000 tons of Chile saltpetre, compared with 650,000 tons in Germany, 280,000 tons in France, 220,000 tons in Belgium, and 105,000 tons in the United Kingdom. Ammonia is available (1) as a by-product in coal gas and coke manufacture; (2) as a leading product in the distillation of lignite or in Mond plant producing power gas, tar, and ammonia from coal or peat; (3) by recovery from organic refuse; (4) by production from calcium cyanamide: (5) by synthesis from N_2 and H_2, using the Haber process. Nitric acid may be obtained (1) from Chile saltpetre; (2) by the arc process for oxidising atmospheric nitrogen—an American process (Rankin) of considerable promise as regards yield and general economy is emerging from the experimental stage; (3) by oxidising ammonia, using the Ostwald process.

Quotations for 95 per cent. Chile saltpetre ranged from 1·075 to 1·235d. per lb. at New York between 1911 and 1913; last spring the price was 1·9d. per lb. A heavy export duty is levied by the Chilean Government, so that in this and other directions the price of Chile nitrate could be reduced materially to meet competition. When obtained as a by-product, ammonia may be sold at slightly above the interest cost on the recovery plant, plus the cost of operating the latter. When ammonia is a leading product, the cost depends on the cost of materials used and on the return from other products. Cyanamide made at Niagara Falls and consumed in the U.S.A. to the extent of more than 30,000 tons per annum, was valued at £11 4s. per ton. The cost of production of the cyanamide with current at £2 10s. per H.P.-year is £6 14s. per ton. The production of 1 ton of anhydrous ammonia requires the use of 4·12 tons of 20 per cent. cyanamide (costing £27 12s.). Add to this, £7 4s. for manufacturing costs, and the total cost becomes £34 16s. per ton of ammonia. Norton estimates that gases for the Haber process cost "much less than 1d." per lb. of ammonia, giving a total cost of 1½d. per lb., compared with 3½d. per lb. by the cyanamide process. On this basis the Haber process "reduces the cost per ton of anhydrous ammonia from £34 16s. to £14 8s., and possibly much lower."

The pre-war cost of producing 100 per cent. nitric acid from Chile saltpetre was about £22 10s. The cost of production by the electric arc depends chiefly upon the cost of energy. The new Rankin arc process is reported to give a 33 per cent. higher yield than the Norwegian furnaces for equal energy expenditure. If this claim be justified the furnace has great possibilities, especially in the western parts of the U.S.A., where energy costs as little as £1 11s. per H.P.-year. The cost of the Ostwald process for oxidising ammonia is given as £2 10s. per ton of 100 per cent. of nitric acid (including 17s. 6d. for liberating ammonia from cyanamide and concentrating 53 per cent. nitric acid). The cost of production of 100 per cent. nitric acid made by various methods may, therefore, be summarised as follows:—

	Electrical energy, per H.P.-year.	100 % nitric acid, per ton (British).
From Chile saltpetre (at 1914 rates)...	—	£22 10s.
Birkeland-Eyde arc process	£2 5s.	13 3s.
„ „ „	1 11s.	10 11s.
Rankin arc process	1 11s.	9 15s.
By oxidising ammonia (from cyanamide):—		
(*a*) Ammonia at £35 per ton ...	2 5s.	14 17s.
(*b*) „ „ „ ...	1 11s.	13 8s.
(*c*) Ammonia at £23 6s. per ton ...	1 11s.	10 14s.
(*d*) Ammonia at £15 per ton (from Haber's process)	1 11s.	7 15s.

A National Nitrate Industry.—The preliminary to establishing synthetic manufacture of nitrates on a national scale, is careful, but not prolonged, investigation to ascertain which processes are best adapted to local circumstances of the various plants proposed. What is needed is a preliminary research carried out with the same energy as it is proposed to devote to the later industrial developments, and with an expenditure of money proportioned to the magnitude

* *Scientific American*, pp. 394, *et seq.*, April, 1917.

of the interests at stake. The line of procedure suggested by Norton, though applying primarily to American conditions, is worthy of our consideration. The first step is to decide to what extent we can dispense with hydro-electric power and utilise coal refuse, peat, or even power from our largest central stations of normal type. Where cheap water power is available (as in certain of our Colonies), its possibilities should be investigated. *

Experimental plant should be laid down as follows:—(1) A 5,000-H.P. unit to test the new Rankin arc process. (2) A unit adequate to determine the acid yield and production costs of the Ostwald process (which was refused a patent in Germany on the ground that all the essential facts were already known). (3) A plant adequate to determine the cost of Haber's synthetic process for the manufacture of ammonia from hydrogen and nitrogen. (4) Norton proposes an experimental Mond plant of 5,000 H.P. operating on cheap or waste coal; another dealing with 500 tons per day of lignites; and a third for utilising peat on a large scale. These experimental plants would hardly be required in this country, the Mond plant and its costs being well known.

Probably in every country it would pay to use more than one process; thus Norton suggests that the arc process might be best in the North-West (U.S.A.), whilst the oxidisation of ammonia to nitric acid might be cheaper on the Atlantic seaboard. In a remote district where coal is cheap, the best practice might be to obtain ammonia by the Mond process, use the power gas to fix atmospheric nitrogen by the arc process, and obtain ammonium nitrate as final product, which, owing to its high nitrogen content, is economical for long-distance transport. All the fixation processes at present in industrial use are likely to remain so, and to extend in application according to local circumstances. Further progress will be made, but the general problem of fixing nitrogen from that inexhaustible reservoir, the atmosphere, is already solved, and the supremacy of synthetic manufacture over natural supplies of nitrate is already asserted.

Whatever the details of practice and organisation, we should be able to supply from within our own borders a peace-demand for nitrates far greater than our consumption in the past, and there should be plant available "capable of vastly increasing, at a day's notice, the current output of nitric acid, to meet the nation's needs in case of sudden danger."

Over-population of the world—a contingency which has troubled many people, however unnecessarily—is practically impossible now that unlimited quantities of atmospheric nitrogen can be fixed to meet the needs of intensive agriculture. An abundant supply of synthetic nitrogen compounds, made within our own frontiers, means an assured supply of explosives and security against starvation in war time. Heavier crops may be obtained with less labour where nitrogenous fertilisers are used liberally. Finally, a national nitrate industry provides profitable investment for capital and labour, benefits industry and agriculture by its products, and improves the balance of trade by substituting home production for importation.

INDUCTIVE AND ELECTROSTATIC TROUBLES ARISING FROM A.C. RAILWAYS.

[COMMUNICATED.]

In one respect at least alternating-current traction systems are more troublesome than direct-current systems. All power circuits are liable to interfere with the proper working of telegraphs and telephones, but experience shows that nothing is more likely to produce trouble of this sort than single-phase railways. Inductive and capacity effects have in some cases led to considerable inconvenience, especially on the Continent of Europe and in America, where single-phase lines are more numerous than in this country. The inductive effect arises from the current in the power wires, and is proportional to the strength of this current, and, therefore, varies with the number of trains that are running on the system. The current, being alternating, produces a varying magnetic field which, in cutting neighbouring telegraph and telephone wires, induces a voltage in them. Obviously the nearer the communication wires are to the power wires the greater does this voltage become. All inductive effects, however, would be eliminated if it were possible to arrange for the currents in the outgoing and return conductors of the railway system to influence the telegraph and telephone lines equally, for as the directions of the currents are opposite the induced voltages would neutralise one another. It is owing to the outgoing and return conductors of single-phase railways being in widely different positions that the inductive effects are far more troublesome than those set up by ordinary power circuits.

Experience shows that the noises produced in telephone receivers arise almost wholly from the harmonic voltages and currents of the power system. This is due chiefly to the fact that the frequencies of the harmonics generally present in the voltages and currents of power systems cover a considerable portion of the voice frequencies, particularly those frequencies at which telephone instruments and the human ear are of maximum sensibility. Extraneous currents of frequencies approaching the average voice frequency have a more injurious effect upon telephone conversation than currents of lower frequencies. The effect of induction arising from the fundamental frequency is comparatively unimportant so far as telephones are concerned.

Interference on telegraph and other signalling circuits, however, is due principally to the fundamental and lower harmonics. Telegraph receiving instruments are relatively insensitive as compared with the telephone, to the higher harmonics, but are sensitive to disturbances by the lower frequencies, such as the fundamental and lower harmonics, which more nearly approach the normal operating frequency of such circuits. From the point of view of telephonic communication, therefore, it is very desirable that every endeavour should be made to employ generators that give as far as possible pure sine voltage waves. There seems to be little doubt that if generators could be designed to give absolutely pure sine voltage waves and without ripples, the interference with telephone speech would be reduced to an insignificant amount.

Among many other single-phase railways that have interfered considerably with the working of neighbouring telephones is the Rjukan Railway in the South of Norway. The telephone lines are supported on ordinary insulators, and are interlaced. Some of the telephone wires are only 3 metres away from the track, and, owing to the fact that this portion of the line passes through a forest, it was impossible to place them in a more favourable position. When the locomotives were put into service the ringing apparatus was found to be very sensitive to the 15-cycle current, and, notwithstanding that the slots in the motors were skewed, and that the specification stated that the generators were to be designed so that no harmonic should exceed 4 per cent. of the fundamental, serious troubles in connection with the telephones were experienced. The starting of the locomotives produced noises in the telephone receivers, and these noises became more pronounced when the locomotives were running at full speed. In some cases it was impossible to use the telephones at all. Investigation showed that the trouble was caused by tooth pulsations in the generators. The harmonic in the pressure wave, mainly responsible for the trouble, was found to have a frequency of 568 cycles per second, and the difficulty was overcome, or, at any rate, considerably diminished, by connecting a resonance circuit across the generators, the object being to provide a path for the high-frequency current, so that no current at this frequency could exist in the overhead line. Experiments showed that a resonance circuit having a capacity of ·2 microfarad and an inductance of ·4 henry gave the best results. The current in the resonance circuit was found to be only ·36 ampere, indicating that the alternators had high resistance.

Resonance shunts have been employed to eliminate the effects of induced voltage on telegraph circuits. In this

* The cheapest site Norton has located in the States is one capable of yielding 150,000 H.P. at £1 5s. per H.P.-year *cf.* 8s. 4d. in Iceland; 8s. to 20s. in Norway; £2 5s. at Niagara on the Canadian side, and £4 4s. on the American side.

case, however, the shunts are connected to the telegraph circuits themselves, and not to the alternating-current power circuit. The shunt provides a path of low resistance for alternating currents of the frequency for which it is designed, but affords no path for the direct current which operates the circuit. With the aid of these shunts it has been found possible to make certain signalling circuits workable that were previously unworkable; although at high speeds the signals are liable to be distorted as a result of the shunt coming into action, and so providing a path for the working current.

Besides the induced currents, earth currents from the track rails are also liable to lead to trouble, but these currents are more easily dealt with. On the Brighton line somewhat elaborate precautions have been taken to minimise these currents, and also the effects of electromagnetic induction originating from the contact wires. In view of the fact that the electrolytic effects arising from alternating currents are less troublesome than those attributable to direct currents, the Board of Trade fixed the maximum permissible drop in the return circuit at 20 volts instead of 7 volts, as allowed for direct-current systems. Special steps were, therefore, taken to assist the current to return to the generating station. Two conductors have been employed in conjunction with the return circuit. On the lines that were first electrified—those between Victoria and London Bridge—each rail length was connected to one of these conductors; but on later extensions the rails have been bonded together, and connection has been made to the cable at wider intervals. The other return conductor is connected at a few points with the conductor which is connected to the rails. In series with this second cable the secondaries of boosting transformers are connected, the primaries of these transformers carrying a portion of the main current. The effect of these transformers, which have a ratio of 1 to 1, is to cause the current to return by way of the booster cable. Leakage from the rails to earth is, therefore, eliminated. Tests have shown that little of the current returns through the rails or the first-mentioned cable that is connected to them, nearly the whole of the current coming back by way of the booster cable.

What influences to a marked degree the inductive effects arising from the current in overhead conductors is the manner in which the lines are fed. If the lines are energised at one end of the system so that telegraph and telephone lines are exposed to the influence of long lengths of contact wire carrying current in the same direction, then electromagnetic and electrostatic influences are likely to become very troublesome. As on the Brighton Railway, the lines should be sectionalised and fed at various points, so that the current traverses the wires in opposite directions, and so tends to neutralise the induced voltages. A railway on which the telegraph and telephone circuits have been considerably interfered with is the New York, New Haven, and Hartford line. Originally the simplest possible lay-out was adopted, the current being fed into the contact wire from a single generating station in such a way that telegraph and telephone wires were exposed to the influence of long stretches of high-tension lines carrying currents flowing in the same direction. Some time ago, however, a new method of feeding the line was adopted, with distinctly beneficial results; in fact, it is said that the new arrangement has completely overcome all difficulties. The new feeding system was adopted partly with a view to raising the transmission pressure and partly to eliminate telephone troubles.

Current is supplied from the generating station through transformers at a pressure of 22,000 volts, but the trains are supplied with current at only half this pressure. The middle points of the secondaries of the 22,000-volt transformers are connected to the rails, and one of the outer ends of each transformer to the overhead conductors; hence the pressure between the contact wires and rails is 11,000 volts. The other end of the secondary winding on each transformer is connected to feeders running at the side of the track. About every two miles along the track auto-transformers are connected between the trolley wires and feeders, and the centre points of these auto-transformers are connected to the rails. Hence, when a train is in a section between two auto-transformers, the current will flow in opposite directions, and the division of current on the two sides of the train will depend upon the position in which the train stands. The unbalanced currents flowing in opposite directions greatly minimise inductive influences; and, further, the length of contact line influencing the telegraph and telephone circuits is considerably reduced.

If a train is situated nearer to one auto-transformer than another, it will draw the greater part of its current from the nearer transformer, and the smaller portion from the more distant transformer. But the net result is the same in each case, for the larger current multiplied by the shorter distance is balanced by the smaller current multiplied by the longer distance.

Use has been made in some cases of neutralising transformers as invented in the first place by Mr. Chas. F. Scott, but these transformers do not eliminate the noise set up in telephone receivers resulting from the harmonic frequencies. In its present stage of development the neutralising transformer has multiple primary and secondary windings connected in series with the line wires of the disturbed telephone system. The multiple primary windings are associated with a group of telephone circuits known as "primary wires," which are earthed at or near the geographical limits of the disturbing zone. These earth connections complete a low-impedance circuit for the induced currents in the primary wires, and cause them to magnetise the transformer core. By virtue of the transformer action electromotive forces are induced in the secondary windings, and by proper connection of the secondary windings with the telegraph and telephone wires, which are called "secondary wires," these electromotive forces are made to oppose and reduce the voltages induced in these wires by the disturbing electric system. On account of the choking action of the transformer primaries part of the voltage (90 per cent. or more) induced in the primary wires acts as an exciting electromotive force for the transformer primary winding, so that the difference of potential between the ends of the primary wires is reduced by approximately this amount. The use of these neutralising transformers, however, will not by any means eliminate all noise disturbances, for they only reduce the voltages induced in telegraph and telephone lines, by currents at the fundamental frequency. Moreover, residual voltages are always left in the wires, and if the induction is very severe, these voltages may be great enough to interfere with the telegraph sevice. Theoretically, the neutralising transformer has possibilities in the direction of reducing some noise troubles, but practical experience seems to indicate that they are not of much use in this connection. Generally speaking, it may be said that, while neutralising transformers provide means for greatly reducing moderate amounts of low-frequency induction, the limitations and disadvantages of such transformers prevent their constituting a primary protection against inductive interferences. Hence it is necessary in the case of alternating-current railways to work out carefully the methods of distributing power to the trains, so that inductive disturbances are prevented as far as possible.

Electrostatic effects have not, on the whole, proved nearly so troublesome as electromagnetic effects; in fact, on some railways the adjacent telegraph and telephone lines have not been charged at all. Much seems to depend upon the construction of the railway. If, for instance, there are many earthed steel structures, as on the Brighton Railway, the telegraph and telephone lines are shielded, and no electrostatic troubles arise. Like electromagnetic induction, electrostatic induction varies with the frequency of the current in the contact wires. Electromagnetic induction, as already stated, varies with the current, whilst electrostatic induction is independent of the current but is dependent on the voltage. Any drop produced by the current will, of course, reduce the electrostatic effect. One method of getting rid of electrostatic voltages, which has been adopted on the Rjukan Railway, for instance, is to employ discharge coils. The coils used on the Rjukan line have a resistance of 750 ohms. They are connected across the double telephone lines at distances of 2 km., and the middle point of each coil is earthed.

No electrostatic disturbances have been met with on the Brighton lines, but on the single-phase section of the Midland Railway (the Lancaster, Morecambe, Heysham

section) both electromagnetic and electrostatic effects have been observed.

On this railway wooden supports are used for carrying the contact wires, and this probably accounts for the electrostatic effects being more pronounced than those experienced on railways using steel structures. Electrostatic effects were considerably reduced by erecting an earth wire between the power wires and the telegraph wires parallel with the track. The telegraph lines have also been earthed through resistances.

No doubt in time to come other methods will be found for dealing with these telegraph and telephone difficulties. On some of the Continental lines the inductive effects have been very troublesome indeed, and have only been overcome after shifting the wires well away from the power circuits. The method of feeding the contact wires is undoubtedly the main point that demands consideration when designing single-phase traction systems, and if proper attention be paid to this matter, a good deal of the trouble associated with telegraph and telephone circuits can be avoided.

MAGNETO FLASH LAMPS.

The development of metallic filaments has extended enormously the use of small and medium-sized electric lamps, as well as those of higher candle-power. The demand for very small lamps (such as "flash lamps") is reckoned in millions, and to provide current for these there has grown up a distinct and important branch of the electrical industry, manufacturing small primary batteries and storage cells. The latter are capable of yielding a suitable current for a long period, but the cells themselves are heavy, the use of acid in "pocket lamps" is objectionable, and the necessity for periodical recharging involves delay (or duplicate batteries), and limits the use of the lamp to within easy distance of charging facilities. The use of storage cells is best restricted at present to comparatively large semi-portable sets (for bedroom lighting and similar service), and to cases such as that of miners' lamps, for which proper provision can be made for recharging at frequent, regular intervals. For ordinary flash-lamp service dry batteries offer the advantages of light weight and independence of current supply for recharging purposes. There, however, the advantage of the dry battery ends. There have been extraordinary improvements in the manufacture of small dry cells, but nothing can alter the facts:—(1) That a dry cell is most suitable for yielding some thousandths or some hundredths of an ampere, and not at all suitable for yielding ¼ ampere or more for any considerable period. (2) Evaporation of moisture gradually increases the resistance of the cell, and, far more serious, "local action" consumes the active materials even when the cell is on open circuit. (3) A stock of batteries cannot be kept for replacements; cells must be used soon after they are made if their performance is to be at all satisfactory. (4) Current provided by small dry cells is disproportionately costly. Only the immense convenience of small electric lamps and the lack of a better means of providing "pocket current" have been responsible for the enormous present-day utilisation of flash-lamp batteries. That there is room for a better method of providing current goes without saying, and one solution to the problem is described by W. Wedding in a recent issue of *E.T.Z.*

Briefly, this method consists in the use of a small magneto-generator driven by a spring in which energy is stored from time to time by the user. Suggestions have been made to use compressed air or gas generated as required to drive a small motor coupled to a dynamo, but such an equipment could hardly be sufficiently light, strong, and cheap. A similar and much more practicable idea is to use muscular energy derived from the person carrying the lamp, to generate current for its incandescence. Several attempts have been made, but Karl von Dreger (Budapest) seems to have been the first to devise a convenient equipment of suitable form and power. A useful output of one to two watts is derived from the thumb or from the four fingers used together to move to and fro a lever or grip bar which is coupled through a suitable clockwork and spring to the armature of a magneto-generator. In order to keep the gear ratio and losses as low as possible, the dynamo armature is driven at comparatively low speed, and full use is made of the space available in order to obtain high peripheral speed. Obviously, the armature speed must be kept as nearly as possible uniform, but, with so low a total power available, it would be a mistake to adopt any form of braking to control the speed. Dreger's method is to balance the load imposed by the lamp on the dynamo, and the mechanical connection between dynamo, spring, and driving lever, so that when the latter is worked in the ordinary way, the armature speed is practically constant after the lamp reaches normal brilliancy. The spring works practically uniformly between ⅓ and ⅔ tension, and the available one or two watts keeps it under this tension during normal working.

By using several springs, which come into action successively, enough energy can be stored to keep the lamp burning for a short time without working the driving lever during that period. Such provision for storage of energy increases the weight and cost of the equipment. Even the simpler form of lamp is rather heavy as compared with battery lamps; for instance, a thumb-driven magneto lamp

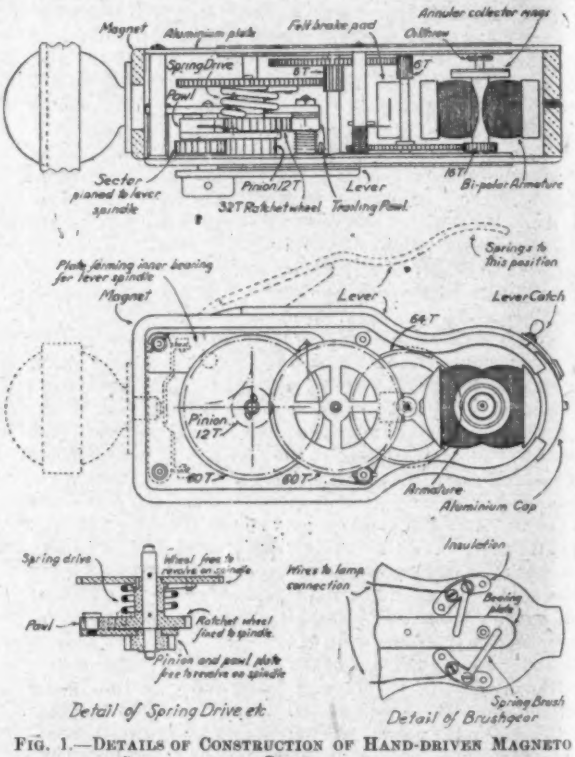


Fig. 1.—Details of Construction of Hand-driven Magneto Lamp.

without storage weighs about 1 lb., and if additional mechanism be added to yield 3 minutes' storage, the weight increases to 1 lb. 14 oz., which is sufficiently heavy, for a pocket-lamp. The more powerful hand-lamp, operated by opening and closing a finger grip, weighs 2 lb. 2 oz. without storage, and 5¼ lb. if provision be made for 10 minutes' storage. (Presumably the spring grip has to be worked for 10 minutes to provide for 10 minutes' "independent" burning?).

Though a lamp with these general characteristics will undoubtedly be useful in special applications, there is certainly no reason to anticipate that battery lamps will fall into disuse. The higher first cost (not stated) of the magneto lamp is admittedly compensated to some extent (possibly completely) by the elimination of battery renewals, but the weight of the magneto lamp and the necessity for driving it continuously, or nearly so, are serious drawbacks. A light set which could be wound up at intervals like a clock would be more convenient in practice.

A somewhat different type of magneto lamp, due to O. Pletscher, utilises a rotating ring magnet running between the poles of a double-T armature. Driving is by periodic depression of a small lever, and the stationary armature is connected permanently to the lamp. The rotating magnet acts also as fly-wheel, and runs on ball bearings. No springs are used, the driving lever acting simply through a 1 : 20 gear train. The magnet runs at 1,200 R.P.M., and the weight of the set complete is ½ lb. A heavier set (1¾ lb.) is available for use on bicycles, the drive being then taken from a roller pressing on the front tire. Other applications suggested for this equipment are in ignition apparatus, sirens, and door alarms.

Our contemporary, *The Model Engineer and Electrician*, in its issue of March 29th, 1917, published a very detailed description of one of these German lamps, which was picked up on a battlefield in France. The following particulars are obtained from this source.

Fig. 1 shows the details of construction. It will be seen that the permanent magnet forms the case of the machine; it is $1\frac{1}{16}$ in. wide, No. 10 gauge, and weighs 5 oz. Between its poles is a bipolar armature, 1⅛ in. in diameter, $\frac{9}{16}$ in. across the core, and ⅛ in. across the end; it is wound with No. 28 enamelled copper wire, has two concentric slip springs, and weighs 1½ oz. The core is machined out of the solid, and runs on a spindle $\frac{5}{32}$ in. in diameter, with pivots about No. 18 gauge. Two plates of aluminium, No. 18 and No 22 gauge, form the sides of the case, and carry thin steel bearing plates; they are connected by four $\frac{3}{16}$ in. steel pillars. The sector plate connected to the hand lever has seven teeth, gearing with the first pinion, which carries a pawl on a plate to drive the ratchet wheel.

The hand lever is ⅝ in. wide, and is stamped out of No. 15 gauge steel plate; it is held closed by a catch, and when this is released opens to the working position under the action of a spring. All the parts, except the lampholder and the aluminium cap, can be assembled before the permanent magnet is placed in position, the magnet being held in place by screws passing through the cap, and screws which fix the lampholder to the base of the generator. The pinion driven by the lever has 12 teeth, and the ratchet wheel 32 teeth; between the latter and the main driving wheel (60 teeth) is a strong spring of No. 13 steel wire. The train of gearing consists of pinions having 8, 6, and 16 teeth and wheels of 60, 60, and 64 teeth, so that the armature revolves about 300 times for one revolution of the main driving wheel. The full travel of the lever rotates the first wheel ¼ revolution, and therefore drives the armature through 75 revolutions; at 40 impulses per minute this gives an average armature speed of 3,000 R.P.M.

In the drawing a small felt pad is shown, which is held by a spring in contact with the top spindle. The lamp is suitable for 3·5 volts, 0·2 ampere. The generator, complete with the lampholder, weighs 16½ oz.; it is 4¾ in. high, 1½ in. across the side plates, and 1⅛ in. wide. The author of the article, Mr. F. Westmoreland, who owns the lamp, states that it gives a very good light. Many more details, with photographs, are given in the original account. Obviously, there is practically no storage of energy in the lamp apart from the spring—which is merely a maintaining spring—and the fly-wheel effect of the rotating parts.

ELECTRICAL WORK AT THE PHYSIKALISCH-TECHNISCHE REICHSANSTALT, CHARLOTTENBURG, IN 1916.

The *Elektrotechnische Zeitschrift* for September 13th gives some details of the work carried out at the Reichsanstalt during 1916, and the following notes refer to the portions of more general interest.

Exhaustive experiments were carried out on substitutes for ebonite to determine the suitability of such materials as insulators in electrical instruments, &c. The following points were considered in the research:—

1. Surface resistance under various test conditions.
2. Absorption of water.
3. Action of dilute sulphuric acid.
4. Action of heat (hot water, Bunsen flame, electric arc, &c.).
5. Whether easily worked (machined).

As a result, five substances were found to be equal on the average, and in some respects even superior, to ebonite. The actual results are confidential.

The test methods for instrument transformers which had previously been drawn up at the request of the Verband deutscher Elektrotechniker were supplemented so that at any ratio both the correction and the angular error can be read off directly on the arrangement adopted. The sources of error were fully investigated, and it was found that with the arrangement used they could be entirely eliminated. Comparative measurements on potential transformers by the new method and the electrometer method gave values in good agreement.

A method of measuring the phase angles of current-measuring resistances in a double bridge for alternating currents of technical frequency was devised. Phase calibration is effected by displacing suitable condensers mounted with cranked handles. Even with resistances of 0·0005 ohm there is close agreement between the measurement of the time constants to 10^{-7} sec., or of the phase angles to $\frac{1}{10}$ minute at 50 cycles per second.

A new type of vibration galvanometer was constructed which can be calibrated at a distance by electromagnetic excitation. The instrument is a needle galvanometer with crossed magnetic fields similar to the Rubens instrument. The needle is magnetised by an electromagnet and this excitation causes a change in directive force, and, consequently, in the calibration of the needle. The instrument has two internal attachments having needles of different dimensions: the first attachment can be calibrated for frequency ranges from 8 to 70 cycles per second, and the second for ranges of from 30 to 140 cycles per second. The image projected by the mirror remains in the field of view during change of calibration, and can be seen immediately the new internal part of the instrument is inserted. The sensitivity is given as 10^{-7} amp. for 1 mm. deflection at a scale distance of 1 metre.

A series of experiments was carried out on chrome-steel magnets with the result that such magnets, when of right composition and properly treated, can be used as brake-magnets in meters, being practically as good as those of tungsten-steel in respect of invariability and non-dependence on temperature.

THE WORKING COSTS OF THE PRINCIPAL PRIME MOVERS.

By OSWALD WANS, of Lincoln, M.I.Mech.E.

(*Abstract of paper read before the* Institution of Mechanical Engineers.)

The object of this paper is to give data that will be of service in estimating capital expenditures and working costs, and in establishing the relative commercial values of the principal prime movers. For this purpose typical examples of the following prime movers will be considered:—

Suction-gas engines and plants burning anthracite, coke, and wood refuse.
Gas engines using town gas.
Oil engines of the solid injection high-compression type.
Diesel engines.
Steam engines.

The scope of the paper includes units up to a working load of 500 B.H.P., a power range embracing the engines for which there is by far the greatest demand.

The items constituting the total working cost are:—

Capital Charges:—	*Running Charges*:—
Depreciation.	Cost of fuel.
Insurance.	Cost of lubricating oil.
Interest upon capital expenditure.	Cost of water supply.
	Cost of sundry stores.
	Cost of labour.
	Cost of repairs.

Rent and taxes must be considered in addition, but owing to the wide variation in their amounts, it is not possible to make allowance here.

Capital Expenditure.—This should cover the total cost of the completed installation in working order. Buildings and floorings have not been included, as their cost varies widely, being largely dependent upon the taste of the purchaser.

The cost of the buildings for internal-combustion engines would be less than for a steam plant, and this applies equally to suction-gas engines, for the producer and cleaning plant do not require a covering, whereas some form of protection is necessary for a boiler. Cooling towers have been included in all cases, with the exception of the smaller gas and oil engines of about 50 B.H.P., as the more usual practice is to employ cooling tanks suitable for thermo-siphon circulation.

When deciding the size of the engine, it is necessary to consider its overload capacity, for this factor greatly affects the capital expenditure, the reliability, and the fuel economy.

The larger overload carried by a steam engine is a characteristic of considerable value in the handling of fluctuating and peak loads. Moreover, this advantage is attained without impairing the fuel economy at the working load. Unfortunately, this feature is not possessed by an internal-combustion engine.

For the purposes of comparison it is necessary that similar load conditions be considered for all installations. A common maximum load of 35 per cent. above the mean working load consequently has been assumed, and the effect upon the capital expenditure is illustrated by the following table:—

Plant.	Rated working load.	Rated maximum load.	Necessary increase in rated maximum load to give 35 per cent. overload.
Steam engine ...	100 B.H.P.	135 B.H.P.	Nil.
Oil engine ...	100 B.H.P.	115 B.H.P.	17½ per cent.
Diesel engine	100 B.H.P.	115 B.H.P.	17½ per cent.
Gas engine ...	100 B.H.P.	110 B.H.P.	23 per cent.

The expenditure curves, fig. 1, give the total cost per B.H.P. at the rated working load, from which it will be seen that the cost of suction-gas engine and plant of 100 to 110 B.H.P. is £8.3 × 100 = £830, as against £8.1 × 123 = £997 for a 100 to 135 B.H.P. engine. That is to say, the cost of the gas engine is increased by approximately 20 per cent. in order

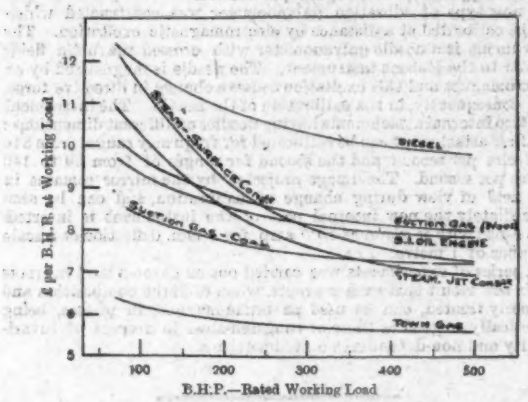


Fig. 1.—Capital Expenditure Curves.

that it may perform a duty equivalent to a steam engine of 100-B.H.P. rated working load. This example serves to illustrate how necessary it is when comparing capital expenditures to place the comparison on "all fours" as regards power capacity.

Depreciation.—The depreciation charge is considered as the annual amount that should be written off the capital expenditure to cover the deteriorating value of the plant as regards obsolescence. This definition does not agree with general usage, inasmuch as wear and tear are not included.

In the author's opinion this departure is justified because:—

1. Developments are nowadays so rapid that there is an increasing tendency for a power plant to become economically obsolete before it is worn out.

2. The allowance made for repairs should be sufficient, in a modern engine, to cover wear and tear during its econo-

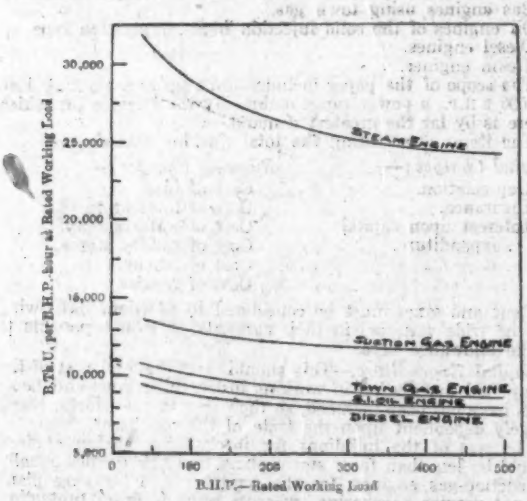


Fig. 2.—Fuel Consumption Curves.

mical life, whilst serious breakages should be covered by insurance.

It is considered that a uniform annual rate of 8 per cent., equivalent to 12½ years' service, fulfils the conditions, and that this rate should apply to all the prime movers under consideration.

Insurance and Interest.—The cost of insurance is a small item; the premiums range from about ¼ per cent. of the cost in the case of boilers to about 3 per cent. for Diesel engines. The rate of interest upon the capital expenditure has been taken as 5 per cent. in the working cost curves, fig. 4.

Cost of Fuel.—The accompanying curves, fig. 2, show the average consumptions in B.TH.U. per B.H.P.-hour at the rated working load. These values hold good only when these loads are carried continuously, and are affected by load factor and peak loads.

To effect a comparison a common overload of 35 per cent. will be assumed again. This condition necessitates the underloading of all the installations with the exception of the steam plant; this underloading increases the consumption, and the curves, fig. 3, show the average percentage increase for a given decrease in load below the rated working load.

These curves clearly indicate the importance of the correct determination of the load factor, and the absolute necessity of considering similar load conditions in order that a true comparison may be made. A further allowance must be made for the stand-by losses of suction-gas and steam plant.

The following values, expressed as a percentage of the fuel consumption at the rated working load for a working week

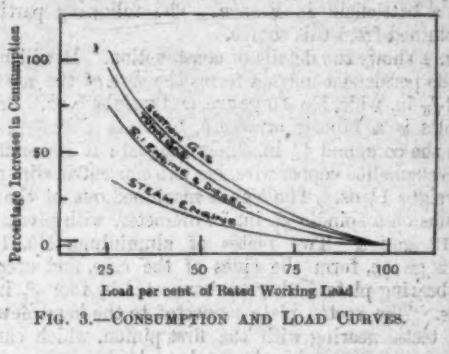


Fig. 3.—Consumption and Load Curves.

of 60 hours, have been included in the working cost curves, fig. 4:—

Suction-gas plant:	Anthracite	8 per cent.
	Wood	6 per cent.
Steam plant		15 per cent.

In cases where the plant runs continuously throughout the week, the losses will be about one-third, assuming that the fires are kept alight over the week-end.

Cost of Lubricating Oil.—The quantity of lubricant necessarily varies widely in practice, and to cover amply these factors, the charges should be of a liberal nature. Representative curves are given in the paper.

Cost of Water Supply.—In many localities a plentiful and gratuitous water service is not available, and the local charges render necessary a closed system whereby, with little loss, the water can be used repeatedy. In the expenditure curves, fig. 1, the cost of a cooling tower is included for internal-combustion engines above 50 H.P. and for surface,

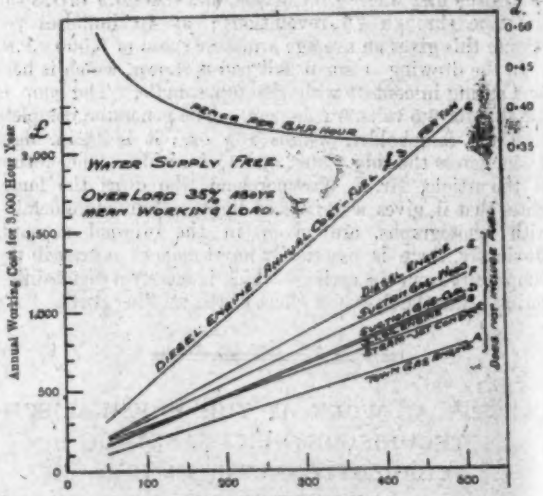


Fig. 4.—Working Cost Curves.

but not jet, condensing steam engines. The water lost by evaporation, in passing through the cooler, may be taken as 5 per cent. of the total water in circulation. The following table (p. 393) gives the make-up water necessary to replace the cooler and cleaning-plant losses.

Cost of Sundry Stores.—The payments arising from these items are small, and are generally covered by a charge of 0.01d. per rated B.H.P.-hour for any of the prime movers under consideration.

Cost of Labour.—The charges under this heading should include not only the attendant's time during running hours, but also that needed to clean, grind in valves, &c., and generally to keep the installation in good condition.

Total Water Lost. Gallons per Working Load B.H.P.	
Steam engine	21-22
S.I. oil engine	0.325
Diesel engine	0.275
Gas engine: Town gas	0.375
Anthracite and coke	2.2
Wood, &c.	5.87

Wages at the rate of 6d. per hour have been allowed for in the cost curves, fig. 4.

The following formulæ give a fair indication of the time that is spent solely upon the prime movers within the scope of this paper:—

Suction-gas (wood fuel) and steam engine plants	$0.8 + 0.0047$ B.H.P.
Suction-gas (coal and coke fuel)	$0.6 + 0.0041$ B.H.P.
S.I. and Diesel engines	$0.3 + 0.0036$ B.H.P.
Town-gas engines	$0.2 + 0.0017$ B.H.P.

These expressions give the labour in hours per rated working load per hour. Thus for a 100-B.H.P. suction-gas plant using wood fuel, and a 100-B.H.P. town-gas engine, the labour would be respectively 1.27 and 0.37 hours per hour's run.

Cost of Repairs.—The annual charge should provide amply for wear and tear, and such breakages as are not covered by insurance.

The following are the repair charges allowed for in the working cost curves, fig. 4:—

Diesel and S.I. oil engines, town-gas engines	3 per cent. of engine cost.
Suction-gas installations	3 per cent. of engine and producer costs.
Steam installations	2½ per cent. of engine, boiler, and auxiliary costs.

From the foregoing data it is possible to estimate with reasonable accuracy the annual working costs of the engines under consideration. Water and fuel are the ruling factors;

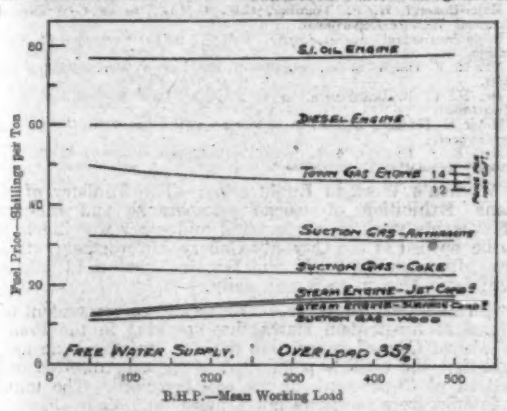


Fig. 5.—Fuel Price Curves.

curves are given with water at 9d. per 1,000 gals., and with water free, the latter of which is reproduced in fig. 4. None of the curves A to F include the cost of fuel, but curve G represents the total annual working cost of a Diesel engine using fuel-oil at £3 per ton. It follows, therefore, that the total amount that may be spent annually upon fuel to give equal running charges for any one of the remaining installations is represented by the length of the ordinate between the curve G and the cost curve of the particular engine considered. From the total fuel cost thus obtained, the maximum prices that may be paid can be easily computed, and have been plotted in curves fig. 5, whilst the fuel prices given by those curves for plants of 250 B.H.P. mean working load are given below:—

	Price of fuel. Curve, fig. 5.	Price ratio.
Diesel engine	60s. 0d. per ton.	0.785
Solid injection oil engine	76s. 6d. per ton.	1.0
Suction-gas: Anthracite	31s. 6d. per ton.	0.41
Coke	23s. 0d. per ton.	0.3
Wood	12s. 0d. per ton.	0.157
Steam engine:		
Jet condenser	16s. 0d. per ton.	0.21
Surface condenser	15s. 0d. per ton.	0.195
Town-gas engine	1s. 1d. per 1,000 cu. ft.	0.014

In the curves, the engine possessing the highest thermal efficiency, namely, the Diesel engine, has been taken as a convenient basis using fuel oil at £3 per ton. Reference to these curves shows that the relative fuel prices for the several installations are fairly uniform for the range of powers under consideration.

As the power increases a higher price may be paid for coal, and the steam engine becomes a more serious rival of the suction-gas plant; nevertheless, for installations up to 500-B.H.P. working load the latter well holds its own, for it is possible to obtain even running costs with fuel ranging in price, according to the power, from two to three times that permissible for a steam plant. The price allowable for town gas is practically constant at 1s. 1d. per 1,000 cu. ft., and consequently confines the use of the town-gas engine to cities in which gas is procurable at this low rate.

Calorific Values Assumed.

Anthracite	14,500 B.TH.U. per lb.
Coal (boiler)	13,500 B.TH.U. per lb.
Fuel oil	18,000 B.TH.U. per lb.
Wood refuse	5,800 B.TH.U. per lb.
Town gas	540 B.TH.U. per cu. ft.

Turning now to the high-compression solid-injection oil engine, a high price may be paid for fuel oil, namely, £3 16s. per ton, as compared with £3 for the Diesel engine, notwithstanding the higher thermal efficiency of the latter engine. The lower capital expenditure and other running charges of the solid-injection engine are responsible for this result.

Before the war fuel oil could be obtained at an average price of £3 a ton. An adequate supply is of the utmost importance to manufacturers. With fuel oil at £3 a ton, the price of coal must not exceed on the average 25s. and 12s. per ton respectively for suction-gas and the larger steam plants over 250 B.H.P. in order that the total annual running charges shall not exceed those of an oil-engine of the solid-injection type. Considering the refuse suction-gas plant, the price of fuel, ranging from 11s. to 13s. a ton, even with a free water supply, limits its use to industries in which the refuse is a waste product of the industry.

It has been shown that the cost of fuel has a deciding influence upon the working cost, although that due to the necessary water supply may be serious in some districts. The maximum permissible prices that may be paid in any locality are indicated by the curves, fig. 5. The practical application of these price ratios shows that each type of engine has its particular field of action in which it can be used with commercial advantage, provided due regard is paid to the local conditions, or, in other words, an exclusive claim to minimum working costs cannot be rightly made on behalf of any one of the prime movers under consideration.

However thermally efficient an engine may be, the ultimate test is a commercial one involving the market price of fuel, which must always depend upon the facilities for distribution from the source of supply. In practice, therefore, railway and shipping freights have a marked and direct influence upon the type of engine giving the most favourable performance from the commercial standpoint.

FEDERATION OF BRITISH INDUSTRIES.

Mr. F. Dudley Docker, C.B., the retiring president of this Federation, delivered an address at the annual meeting, held at the Connaught Rooms, on Friday last. Having referred to the growth of the Federation and to their prospect of being able to prove themselves a power for good in the welfare of the Empire, he said that the grave danger which faced all associations was stagnation. They must progress if they were to be useful. The first regular step towards stagnation was to have a perpetual president, therefore he declined, though with much personal regret, to be nominated for a second term. No better man could be found for the office than Sir Richard Vassar Smith, whom the Executive Committee suggested. Mr. Docker alluded to the complaint that subjects in which they were specially interested had not been taken up by the Federation, or that pronouncements had not been made on questions exciting popular interest. In many instances, while the Executive Committee did not appear to have taken any action, they had, in fact, been making careful inquiries and doing quiet useful spade work, and had only decided, after careful consideration, to avoid or sometimes to postpone taking action. It had not been lack of interest or want of energy, but a sense of responsibility that had induced the Executive to refrain from public reference to these matters. The position which the Federation had gradually built up was that of being the representative organisation of British manufacturers, and it was obviously wise to refrain from embarking lightly on any project, and to avoid subjects of secondary importance.

A question that must be considered by the Federation was the policy of protecting our trade against foreign aggression. This was a subject of absorbing interest to them as manufacturers, and it was not one that could be disposed of in a rough and ready way. There was no summary solution. They must consider and determine if any duty should be imposed, and on what goods, and whether or not preference was to be extended to our Oversea Dominions, or to any and which of our Allies. Again, they must consult with the Government as to the method by which any tariff, when constructed, could

be used as a power to bargain with foreign nations. Personally, he was absolutely certain that they must have a power to bargain, but he strongly objected to this procedure being called Protection or Tariff Reform. This matter must have their earnest consideration, and he attached supreme importance to it, but there was a grave difficulty in the way. This Federation was an industrial association, and he would be sorry to see it in alliance with any political party. It would be detrimental to their interests to be labelled Liberal or Tory, or with any other political designation, and unfortunately the questions of Free Trade and Protection had become party measures, and one or other was included in the respective programmes of the two great political parties. Should it become necessary in the judgment of the Federation to advocate the imposition of a duty on any article in the interests of the manufacturers of this country, he would not object to such action, for it would be done definitely in the interests of British trade, and not at the request or instigation of any politician. If such a duty were imposed, in his judgment it should be used deliberately as a means of bargaining with foreign Governments to obtain facilities and preference for British trade. He was quite ready to support action by the manufacturers, but he deprecated that this Federation should be called a Free Trader or a Tariff Reformer. These terms belonged to politics, from which this Federation should keep itself absolutely free. Another important question of pressing concern was the relation which education must bear to industry. A sub-committee had been considering the proposals formulated by the President of the Board of Education, and they had invited the members of this Association to express opinions on certain subjects for the guidance of the Committee. This question of education lay at the root of a great many of their difficulties. If they were to be successful in competition, they must provide for the better education of themselves and their workpeople. One of the causes, in his opinion, of industrial unrest was the lack of knowledge; it was a fruitful agent for the generation of suspicion, and he therefore urged that the Federation should concern itself particularly in fostering in no niggardly spirit the spread of education. Allied with education was the sense of discipline There was no doubt that the lack of discipline created an irresponsible condition which was detrimental to all well-being. One and all, they should do their utmost to help on such movements as the formation of cadet corps, which while improving the physique of their young people, at the same time inculcated a respect for authority, and a desire to play for the side, rather than encourage selfish tendencies. During the past year the Association had done well; their foundations were solidly laid, and they had obtained recognition from the Government. *The Prime Minister had authorised him to say that he would welcome any federation of industry, and expressed an opinion that such an association would be of assistance to any Government.* They must go on, and it should be their object to obtain some recognition and status in the eye of the law that would place them in as favourable a position as the Trade Unions now occupied. Mr. Docker said he desired to publicly tender to Sir William Peat, Mr. Oldham, and Mr. Nugent and Major Caillard in particular, and in general to the chairman of the various sub-committees, and the office staff, his very hearty thanks for the efforts they had made to carry on the work and to create a sound and efficient organisation.

Sir William B. Peat, in proposing a vote of thanks to Mr. Dudley Docker, said that Mr. Dudley Docker was the pioneer not of trade combinations, which had existed for 20 years, but of a combination which should embrace all trades—a far larger and far grander idea—a combination which embraced, or might embrace, not alone the capitalist interests of the country, but the labour without which that capital could not succeed.

In responding, Mr. Docker said that the Federation was the idea of his life. He had always thought, and always hoped, that manufacturers would all come together to help this great country. "We were the greatest manufacturers in the world if we only knew it." Their influence was greater than they had the least idea of. Individually it was nothing, collectively it was everything. He hoped the membership of the Federation would largely increase. He was also hoping that they would have a home of their own where they would meet together and discuss the great subjects of the day, and that their weight would be so great that the Government would consider them and talk to them.

Sir Vincent Caillard (Messrs. Vickers, Ltd.) proposed the election of Sir Richard Vassar Smith as President of the Federation for the ensuing year. He joined in the expressions of regret that Mr. Docker should vacate the presidential chair. This great Federation had immense problems to face and solve. To accomplish successfully its objects, which were not confined to that country, or even to the Empire, but were world-wide, would require on the part of all the members of the Federation breadth of view, untiring energy, unfailing courage, conciliation, and determination. Sir Richard Vassar Smith was known personally to a great many of them, and by reputation was known to them all. In him they had all the necessary qualities enumerated in a very high degree.

The resolution was carried unanimously.

The following gentlemen were elected vice-president of the Federation for the ensuing year: Mr. Dudley Docker, Lord Aberconway, Sir Vincent Caillard, Mr. A. H. Dixon, Sir Algernon Firth, Sir Robert Hadfield, and Mr. W. Peter Rylands.

On the motion of Mr. Docker, seconded by Mr. H. B. Renwick (County of London Electric Supply Co., Ltd.), the first annual report was unanimously received and adopted.

Mr. W. Peter Rylands (The Iron and Steel Wire Manufacturers' Association of Great Britain and The Wire Netting Association) said that the appointment of an Executive Council was probably the most important business with which their Federation had to deal. A committee was appointed to consider the whole matter, and had made recommendations. The lines upon which those recommendations had been framed had been those of endeavouring to construct an executive which should be representative of industry by groups, so that each group of industries whose interests were more or less analogous should themselves directly elect their representatives to the executive. When they came to consider the question of groups they found considerable difficulty. There were the big main groups of industries, and there were sub-groups. They also got overlapping in many of the groups, such as that between engineering and the iron and steel manufacturers. Accordingly, the view they took was that the best plan would be to take the big groups of industry as the basis, letting each group decide for itself the sub-division particularly appropriate to the group. They were proceeding upon those lines. The scheme was very nearly complete, and letters were about to be sent out to the secretaries of associations asking for certain material information necessary to construct a constitution upon the lines indicated.

WAR ITEMS.

Ministry of Munitions.—The Minister of Munitions has made the following appointments within the Ministry:—

Major J. W. Hills, M.P., to act temporarily as a member of the Munitions Council in charge of the Labour group during the absence of Sir Stephenson Kent, K.C.B.

Vice-Admiral Sir A. G. H. W. Moore, K.C.B., C.V.O., to be Controller of the Mechanical Warfare Department.

Major-General H. F. Thuillier, C.B., C.M.G., to be Controller of the Chemical Warfare Department.

Brigadier-General A. C. Currie, C.M.G., to be Controller of Munitions Design.

Mr. E. V. Haigh, to be Controller of the Trench Warfare Supply Department.

Mr. H. C. B. Underdown, to be Director of the Agricultural Machinery Department.

Major H. Newton, D.S.O., to be Assistant Director of the Trench Warfare Department.

Mrs. H. J. Tennant, C.H., to be Chief Adviser (Women's Welfare) in the Labour Regulation Department.

Women's Work in Engineering.—The Ministry of Munitions' Exhibition of official photographs and samples of of women's work in engineering and other war industries is to be opened at the City Art Gallery, Birmingham, on Monday afternoon next. It will remain open until November 10th from 11 a.m. to 8 p.m. daily.

German Coal Shortage.—The special correspondent of the *Times* at Amsterdam states that speaking in the Frankfurt Municipal Council concerning the coal situation, one member said that the civilian population of the city received only 15 instead of 40 per cent. of the coal promised. The munition industries were receiving much more than their share. The coal famine would be worse than anything experienced hitherto during the war.

Fuel Shortage in Athens.—In Athens fuel scarcity is acute, although the electric current for public use has already been reduced to a minimum and traffic on several tramway lines suspended. The electric works recently had fuel for one day only, and it is proposed to requisition uncut timber. —*Times.*

The Aron Meter Co.—The German newspapers state that the liquidation has been concluded of the interests in Germany of the Aron Electricity Meter, Ltd., of London, particularly the latter's participation in the firm of H. Aron, Elektrizitäts Zähler Fabrik, G.m.b.H., of Charlottenburg.

Engineers' Bonus.—The Ministry of Munitions has issued the Skilled Timeworkers (Engineers and Moulders) Wages Order, 1917, dated October 13th, 1917 (with a view to ensuring the maintenance of the output of munitions), relating to the remuneration to be paid to fully qualified skilled engineers and moulders of the class specified in the Order for work being munitions work or work in connection therewith which at the time when these directions are given is paid at time rates.

Workmen to whom these directions apply shall receive a bonus of 12½ per cent. on their earnings, which shall not alter or become part of their time rates, the bonus to accrue as from the beginning of the first full pay following October 12th, 1917, and the first payment thereof is to be made as soon as possible, and not later than the first full pay day in November, 1917. The directions apply, subject to the following provisions, only to fully qualified skilled engineers and moulders rated at or above the current district time rate for turners or fitters while employed on or in connection with munitions work and paid at plain time rates without the addition of any bonus other than (*a*) a bonus dependent on

timekeeping, (*b*) a bonus (not being a bonus on output) less favourable to such workmen than the bonus payable under these directions, in which case the existing bonus shall merge in the bonus payable under these directions, (*c*) a war advance given to meet the cost of living as the result of or in conformity with arbitration under Part I of the Munitions of War Act, 1915.

These directions shall not apply to workmen of the class specified above whose wages it has been the practice to regulate by the movements in the wages of men employed in trades other than the engineering and foundry trades. An application may be made to the Minister of Munitions for special directions in cases where the existing basis of remuneration for such workmen is less favourable than that of workmen of the same class to whom these directions apply.

These directions will not apply to workmen paid an upstanding wage or salary which covers overtime or other allowances. Nothing in the foregoing provisions shall affect the present basis of determining piece rates or premium bonus times or any other system of payment by results.

Exemption Applications.—Lewes Tribunal has withdrawn conditional exemption held by A. J. Cox (31, garrison duty abroad), jointer and shift engineer at the Lewes electric light works, and substituted three months' temporary exemption.

According to a Swansea newspaper, a special meeting of the Neath Rural District Council has been held to consider the question of military appeals against certain employés of the Council's electric lighting station. Mr. Thomson, electrical engineer, said that if the military appeals were successful the Council would be compelled to close down one or two shifts, and it would be impossible to carry on the power station without suitable men. It was decided to notify the Council's consumers of the position, and to emphasise the fact that no action would be taken without giving them reasonable notice.

On the recommendation of the Advisory Committee, Rochdale Tribunal has granted conditional exemption to E. Hornby (29, B 2), motorman, appealed for by the Corporation tramway department.

Surrey Appeal Court has granted a final month's exemption to G. T. Church (31, B 1), electrical engineer, of Chertsey.

Lancashire Appeal Court has granted three months' exemption to five electrical men engaged at the works of Messrs. Pilkington Bros., Ltd., St. Helens.

At Walthamstow, the tramway manager (Mr. W. Murray) appealed for 12 tramdrivers, and said that they were in great straits for want of men, and those appealed for could not be replaced. Nine of the men were granted six months, and the others three months each.

At Dawlish, the Electric Light Co. renewed an appeal for C. C. Hodges (31), manager and secretary, who was stated to be doing all the work of the concern, with the aid of two pupils. The Military suggested temporary exemption until a substitute was obtained, but conditional exemption was granted so long as Mr. Hodges remains in his present employment.

Renewed temporary exemption until January 1st has been granted to G. Dring (28), electrical engineer, appealed for by the Ilfracombe Electric Light Co.

Berks. Appeal Court has dismissed a military appeal against exemption granted to J. H. Ferguson (36, C 3), managing director and secretary of the Whitchurch and Pangbourne Electric Supply Co., Ltd.

High Wycombe Tribunal has granted six months' exemption to R. Pugh (40, B 2), electrical engineer.

At Congleton, an appeal was made for the man in charge of the electric light plant at Moreton Hall, placed in Class C 3 after three rejections. He was given conditional exemption until March 31st.

Before the Brailes Rural Tribunal, a review was made of the case of G. F. Hall (33, Class A), electric light attendant to Mr. J. R. King, at Honington Hall. It was stated that an efficient substitute had been offered and refused, and Mr. King said that in addition to working for him, Hall was the only practical man he had to carry on the electric light plant at Shipston. If he went there would probably be no light at Shipston, and the capital of the company owning the undertaking would be in danger of being lost. The substitute offered knew nothing about meters or wiring, and when he found that he would have to do this work he refused to stay. Another substitute sent was only a gardener and painter. The appeal was dismissed, and exemption continued.

The same Tribunal dismissed a military appeal against exemption held by A. W. Whitehead (40, C 2), electrician to Sir Grey Skipwith.

Six months' exemption has been granted to A. F. Pinson (19, C 2), Swanscombe, driver on the local tramways.

At Greenwich, an appeal was made by J. H. Hardwicke (26, C 2), electrician at a Woolwich music hall, and a month only allowed.

At Broadstairs, the Isle of Thanet Tramway & Lighting Co. appealed for five tramway employés as being indispensable until efficient substitutes are found. The manager (Mr. Forde) said that owing to the drain upon their staff it was necessary to reorganise the service. Each man was allowed a month, with the privilege of a personal appeal later.

Before the East Sussex Appeal Court, a Brighton electrician appealed for extended exemption, and the employer said that since the last appeal two improvers had joined up, and he had been unable to replace them. The work was of national importance, and consisted entirely of maintenance work at military hospitals, &c. He himself was a Regimental Quartermaster-Sergeant in the Territorials, was just completing 30 years' military service, and was quite willing to enter into an agreement whereby the Army kept him and released the man. The decision of the Court was a final three months.

On the appeal of the Corporation tramway department, Rochdale Tribunal has exempted until February 28th, F. Walton (29, C 2), overhead linesman, who has been discharged from the Army.

G. Cooper (35, B 1), electrician, applied at Mansfield for his certificate of exemption to be varied. He was granted four months last June, and given the option of going into munition works. He did so, but his health was affected, he being subject to gas poisoning, and he asked to be allowed to return to electrical work on his own account. The request was acceded to, and exemption until January 31st was granted.

At Mansfield, temporary exemption until a substitute is found was applied for by Mr. E. H. Hewlett, borough electrical engineer, for H. Topley (18, Class A), switchboard attendant, whose protection certificate has been withdrawn. Mr. Hewlett stated that the supply of power was very important indeed, and the man's work was skilled. He should like exemption until Christmas in order to get a 16-year-old learner a little more experienced. The appeal was refused.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The E.T.U. and the A.E.S.E.

"Shift Engineer," in his remarks published in the ELECTRICAL REVIEW, makes use of the motto, "United we stand, divided we fall"; but in the case mentioned—*i.e.*, the amalgamation of the A.E.S.E. with the E.T.U.—this motto would be wrongly applied, for the simple reason that there would be a division among the members of the A.E.S.E., the greater number of whom would immediately resign. Apply this motto to the A.E.S.E. only; let all qualified station engineers become united in the A.E.S.E., and make it a strong and creditable Association that engineers will be proud of and that chiefs will look to for assistance.

The suggestion of amalgamation is absurd; no man who is an electrical station engineer in the full sense of the word can at the present time, nor until a very great change has taken place in the social state, meet with the workmen who work under him to discuss their respective salaries and wages, or the general conditions under which they work. The engineer has, in the majority of cases, to act as deputy for either the chief, or president, or mains engineer during his hours of business, and cannot become, or make, a confidant of the workmen.

"C. W. B." is quite correct when he says that "station engineers have a live organisation," but it is the A.E.S.E., not the E.T.U.

The A.E.S.E. is the only organisation that at present represents station engineers. For patriotic motives, also due to a very large percentage of its members being on war service, this Association considered it advisable to discontinue its meetings for the period of hostilities, unless some very urgent business came forward. Unlike certain other societies, the A.E.S.E. does not wish to hamper or delay the progress of the war by causing discontent in generating stations. That has never been the policy of the A.E.S.E. Where there has been discontent it has generally been remedied by the case being clearly stated to those in authority.

I quite agree with "Engineer-in-Charge" in his leading remarks, and he fully explains the unique position of the shift engineer by saying it is "absolutely anomalous."

The apparent results of the A.E.S.E. have been few, but it has done some very good work, in spite of the war and the efforts of the E.T.U. to cripple it. I think it probable that a number of the members of the A.E.S.E. who have been drawn into the fold of the E.T.U. are the agitators who, at the commencement of the A.E.S.E., caused it so much trouble by attempting to force a policy of agitation and disaffection; if so, we must be grateful to the E.T.U. for relieving the A.E.S.E. of a very unpleasant burden.

W. E. R., *Sergeant, R.E.T.*

The Association Movement.

I have only this afternoon had my attention called to the letter in the ELECTRICAL REVIEW, written by Mr. Llewelyn B. Atkinson, Secretary of the Cable-Makers' Association, with reference to the above matter. If Mr. Atkinson has only been closely associated with the Cable-Makers' Association for something over 14 years, he will, perhaps, be more easily pardoned for giving expression to several inaccuracies with regard to facts which occurred some years earlier. It is, however, regrettable that he did not obtain further corroboration for his statements in those quarters where, no doubt, official records could be traced to verify my earlier statements.

I have no "axe to grind" in cable circles, and I have no particular wish or need to stand in the limelight in this matter,

especially if the limes have already been casting their brilliancy elsewhere. Were it otherwise, Mr. Atkinson might have heard of me before.

I must now, however, as I am directly challenged, give further specific details of the actual indisputable facts as they occurred in their exact sequence.

I stated that after a preliminary conversation with Mr. J. J. Easton, my first interview was with Mr. Alexander Siemens. I will now add that my second interview was actually with Mr. Taylor at his factory at Helsby, upon the only occasion on which I have ever visited those works in my life.

It is many years since I met Mr. J. S. Paterson, and I believe he has left the cable industry, but I trust this letter will come before him. Mr. Paterson gave me his active support, and will be able to give an unbiased record of those events.

In my communication, I reported that I only had difficulty in one quarter. I did not expect to find it necessary to refer to that again; but as the necessity arises, I beg to state that it was the late Mr. Robert Gray who, in his own office, informed me that he did not believe it possible for such an Association to exist for any length of time, and he believed in the "survival of the fittest."

My *last* interview of all (how surprised Mr. Atkinson will be!) was with Mr. Henry Edmunds, then chairman of Messrs. W. T. Glover & Co., Ltd. I did not disclose to him my conversation with Mr. Alexander Siemens, but I did state that I had met with almost complete success. Mr. Edmunds's reply to me was that he would see Mr. Robert Gray himself, and that he believed his influence would be effective. Up to that time, I beg to state most definitely and emphatically that Mr. Henry Edmunds had not seen or spoken to any one of the parties interested in this subject, from the time I started the campaign until then, nor had he any knowledge of my earlier movements until I communicated them to him. Almost immediately afterwards, the first preliminary meeting took place, and the subsequent events are no doubt correctly related by Mr. Atkinson.

Mr. Atkinson will, however, perhaps be interested to learn that Mr. Henry Edmunds had some time before, if I am correctly advised (to requote Mr. Atkinson's method of expression), "had the idea to found, or be associated with, a trade organisation." This, however, had a short life, if a merry one, and broke down. I referred to this event in my original communication.

I would mention that the whole of these facts can be corroborated by Mr. J. J. Easton, if his memory serves; if that fails, by the official records of Messrs. Siemens, to whom all progress was reported.

In conclusion, I would like to add that, by placing the genesis of the Cable-Makers' Association on record, I am not wishing to detract from the later efforts of those who have brought this Association to so successful a conclusion, and I am particularly sorry that Mr. Atkinson did not extend his inquiries into wider channels before seeking publicity.

Herbert H. Berry.

London, W. 1, *October 23rd*, 1917.

"A European Concert."—A correspondent at the Front points out that a misprint occurred in the letter under this heading in our issue of September 28th; the supply voltage is not 2,000, but 220 volts. Reference to the original shows that the error on the part of the compositor was not inexcusable.—Eds. Elec. Rev.

The Niche and Its Occupant.

The war is the biggest moral earthquake which has taken place in the memory of man. It is responsible for the overthrow of institutions and customs, generations in the making, which had become as harbours of refuge against the grasping hand of self individual gain. We know that things can never bear the same relationship in the years ahead as they did in the far-away summer days of 1914.

One of the outcomes of the upheaval is the closer relationship between Capital and Labour. It took a European war to enable each to discover the true worth of the other, to find the true meaning of the motto, "Unity is strength," and to sow the seeds for true co-operation in the happy days to come "*après la guerre*." And if half the schemes which have seen the light of day obtain realisation, the world will indeed be a better place.

Unfortunately, the boundary line of labour is tending to become too sharply defined. It is increasingly evident when labour is mentioned that "productive" labour only is referred to. The producer—the man who weaves the article, who produces the tangible result with the toil of his hands and the sweat of his brow—he is the man who will benefit by the utopian schemes held out like sugar plums to a fractious child. But what of the man whose brain created the vision from which the tangible thing was evolved? He is still left where he has, perforce, been compelled to rest in a little niche in the wall—out of harm's way, yes, and quite as easily forgotten as a sculptored saint in a cathedral portal. He is a member of the "staff," and as such is outside the labour qualification. His wage has become a salary, his time-sheet a mere set of numerals on the roll of the clock recorder, his hands are free from the result of daily contact with the crude components of his dream-child. He is a man above, a being apart, but alas! in such a minority that he ceases to be worth consideration when the betterment of the individual lot is on foot.

Co-operation for the producer is in the air. Cannot the flashes which are illuminating the darkness produced by the present chaos shed a little light on the niche in the wall, and awaken the capitalist to a realisation of the untapped source of national energy lying dormant there?

The loyalty of the staff to its chief is beyond reproach. When will he discover their true value, and respond to the mute appeals for recognition, even if it be but the acknowledgment of trust well-placed and well-proved? Its loyalty can become something more than a mere expression of willingness to serve. It can become a real dynamic force urging the manufacturer and producer, and, through them, the nation at large, into new channels of enterprise, and opening vistas of a world-wide expansion at present unattained.

Abolish the niche, give its occupants freedom to expand, eradicate by careful attention all that belittles it, encourage all that expands and ennobles it, as you would your producer, and the day will not be far distant when you will be repaid not thirty, not sixty, but a hundredfold.

F. E. S.

LEGAL.

The Bosch Magneto Patents.

The supremacy of the Bosch magneto was discussed in the Patents Courts on Thursday, last week, when the British Lighting and Ignition Co., Ltd., of 204, Tottenham Court Road, London, W.C., applied for licence to use 24 German-owned patents for these magnetos.

The application was heard by the Controller, Mr Temple Franks, and Sir Cornelius Dalton.

Mr. Hunter Gray appeared for the applicants, who were, he said, a firm formed in May of this year to acquire the plant, machinery, and factory of the Bosch Magneto Co., Ltd., which was practically entirely owned by German capital. This Bosch Magneto Co. had 120 patents or applications. The purchasers direct were Messrs. Vickers, Ltd., who formed the present applicant company to work the plant bought from the Controller. They paid a large sum of money. The works, however, were not manufacturing works. There was merely a repairing shop. The magnetos before the war were not even assembled here. They came over actually completed and assembled, and all the firm did in England was to effect repairs to damaged magnetos. Undoubtedly the Bosch was at that time the best magneto that could be obtained for motor-cars, and a great deal of work had been spent on its evolution. Mr. Gray went on to say that he did not want the licence to be made out for the term of the war only. A company of this size, with a large capital and under the guidance of Vickers, was not going back from the position it must take up, seeing the great amount of money that must be spent to get this industry into this country. A very large sum was paid for the fixed plant, machinery, and factories. The applicant company was formed with a capital of £200,000. Very substantial sums had been spent by the applicants since the purchase was made, and there was no question of the future rate of manufacture. These magnetos were now being made in large numbers. A licence had already been given to the Chesham Supply Co., Ltd., to manufacture (Electrical Review, May 25th); the sum fixed as payable by way of royalty was then arranged at 5s. per magneto. That, under the circumstances, was very generous, and if the Court could see its way to fix a smaller royalty in the case of the present applicants, no doubt that would react, and the Chesham Supply Co. would get the benefit of it.

Sir Cornelius Dalton: I understand that for a motor bicycle before the war the cost of the magneto would be £1 retail, and for a four-cylinder car it would be up to about £12. There must have been a considerable number made.

Mr. Gray: I am told by the manager that the biggest output, which occurred about the year before the war, was 100,000 in the United Kingdom and the Colonies, excepting Canada.

The Controller: If you can give us any reason or consideration why the royalty should be lowered we will hear you.

Mr. Gray: When you consider the great expenses to be incurred, I think you will see there is a reason why a small royalty should be imposed. There are special considerations in this case which do not apply to all applications. He went on to say that the applicant firm were turning out for war work a very large number per week. They hoped to go on increasing that number during the war, and after, but they would not be able to do it unless they got a big market. They could only get that and beat the Germans if they had highly developed works and equipment which would enable them to compete with Germany after the war. The Chesham Supply Co. applied only for nine patents, and only two of those were in the present list. He apprehended they might find it necessary to come to the Court again. The whole of the 26, with the exception, perhaps, of three or four, were embodied in the magneto actually made by the applicants.

If, Mr. Gray said, the Germans were to be allowed to compete without legislative restriction, and to manufacture in this country, and English makers had to pay them a big royalty, they would try to get all the trade back after the war.

Applicants' general manager, Mr. A. Bennett, said he was in the service of the Bosch Magneto Co. from 1907 until it was wound up by order of the Board of Trade. The colonial business grew latterly, but he should say 80 per cent. of the output was for this country, or 80,000. The prices before the war would range from £6 to £50, the last figure for the big stationary gas engines; but for motor cars and bicycles the prices would be from £6 to £12. He calculated that they were doing 90 per cent. of the total magneto business of this country. The plant would have to be multiplied several times to render it equal to producing the quantity the Bosch Co. formerly imported. Mr. Bosch's own explanation of his success was that his works were situated in a part of Germany which was very far away from the natural sources

of supply, and he could only succeed and make money in that part by doing excellent work.

The CONTROLLER: You say the success of the Bosch magneto was due to admirable workmanship?

WITNESS: Yes; and we can secure good workmanship here. We are making magnetos for most of the aircraft at the present time. It is only a matter of experience to get the material up to the excellency that the Germans attained.

MR. GRAY: Did Bosch's ever make machines in this country?

MR. BENNETT: No; we only made machines in London for the purpose of competition where it was laid down that the whole engine had to be of British manufacture. Mr. Bennett added that he would like the royalty to be as small as possible, because he was responsible. He would be quite pleased if it could be fixed at 5s.

An officer from the Admiralty, COMMANDER BRISTOW, giving evidence, said he had been particularly concerned at the Admiralty with magnetos and their use for public purposes.

He agreed that the sum of 5s. for royalty was excessive, and that the offer of the Chesham Supply Co. should not be allowed to weigh on anybody's mind to any degree. They were not magneto manufacturers, but cab proprietors and hirers. The Government have been in consultation with patent experts in this country, and their view was that upon the validity of these patents they could put up a very decent fight. They would challenge the validity of all these patents, except, perhaps, two—one dealing with the central terminal and the lagging pin, and the other a patent on the hole in the contact-breaker cam, which was fitted with a wick taking the oil to the surface of the cam. The number of magnetos imported to this country before the war, as far as they could make out, of all sorts, from America, Germany, and oddments, amounted to 280,000 a year. So that if the trade was struggling under a royalty of 5s. a magneto, it would be paying to Bosch in Germany £70,000 per annum. A licence went on for several years, so that a very big amount at that rate would be paid to the Germans for a number of patents of which it was said that they were not valid. Moreover, it was perfectly true, as Mr. Gray said, that the superior quality of the Bosch magneto did not lie in the patents, but in the workmanship and material, and it had been found quite possible for magnetos superior to the Bosch to be turned out, not embracing any device for which Bosch could claim a patent. Mr. Bennett was perfectly correct when he said their works would have to be very much extended before they could cope with the whole requirements of the country; but he did not think he need be afraid of the German on that particular account. The following companies were also manufacturing: The British Thomson-Houston Co., the British Westinghouse Co., Siemens, Ericsson, Peel-Conner, Thomson Bennett, the M-L Magneto Syndicate, the Watford Speedometer Co., the Fellowes Magneto, and others. The total capital of these companies must run into millions of pounds. For the first five alone the capital was very considerable. All these proposed to continue after the war. All these firms were members of the British Magneto Manufacturers' Association, and they were unanimously agreed that they would fight the Bosch Co. if necessary. He believed that they had established some sinking fund or reserve to enable them to engage in litigation with the Bosch Co. if the Bosch Co. wanted it. The upshot of all these consultations had been that, whatever others might do, they had definitely made up their minds that they would not apply for a licence, and they were anxious that nothing should be done by anybody else to prejudice the position which they had taken up with regard to the validity of the patents. Although the Government saw no objection to Messrs. Vickers having a licence, the Government would not regard with equanimity any clause inserted in that licence which made them appear to be sole licensees. It would not be satisfactory if the Court granted a licence which in any way would enable the Bosch Co. to say at the end of the war that anybody legally acknowledged the validity of the patents for which licence was granted.

The CONTROLLER: The licence would only be between the applicants and the Board of Trade, and no licence for war use could ever be taken to be a general guarantee of the validity of the patent rights.

COMMANDER BRISTOW: Say, for instance, that the British Thomson-Houston Co. were using a certain patent, we should not like it to be possible for the Bosch Co. to say: "It does not matter what you think about its validity. A licence has already been granted in respect of it, and the Patents Court has recognised it." Take the patent for the central terminals and lagging pin. If Messrs. Vickers had taken out a licence for that, we should not like them to be in a position to turn round and say: "We have taken out a licence for this patent, and you cannot now challenge it."

MR. GRAY: They cannot do that.

SIR CORNELIUS DALTON asked Commander Bristow: Do you think it wiser for the present applicants to join the other companies?

COMMANDER BRISTOW: That is a matter I have no opinion to express upon.

The CONTROLLER: What will be the demand for the output of magnetos after the war?

COMMANDER BRISTOW: With 280,000 a year required before the war, it is highly probable that that number will be greatly exceeded after the war. There is a great movement for reforming the motor trade, and by standardisation to place this country in a much better position to fight the importation of these foreign cars.

In reply to the CONTROLLER, COMMANDER BRISTOW said the demand for magnetos for aircraft was likely to increase, as well as for pumps, agricultural machines, and all sorts of things.

MR. GRAY: Now that I have Commander Bristow's support, I am going to ask you, Sir, to give us the licence at a lower royalty.

SIR CORNELIUS DALTON: You still want a licence after hearing him?

MR. GRAY: Yes; if we find that we don't, we can notify you to that effect afterwards. In considering this application I should like you to bear in mind that this is a key industry.

The CONTROLLER: We shall recommend that a licence be granted. It can be borne in mind that the Chesham Supply Co. were only applying, when they were before us, for licence to use for their own particular purpose, and it may be now that we shall be quite prepared to reconsider the whole question of royalty, and to recommend the Board that all people who come for a licence now—and possibly even the Chesham Supply Co.—should have the royalty based on these new considerations. We have in this Court to take into account a variety of considerations: first, how far the patents enter into the process of manufacture, then what is the public interest, and finally the development of the industry. The applicants will be duly notified by the Board of Trade as to their licence, and the conditions on which it is issued.

NEW ZEALAND COMPENSATION CASE.

A DISPATCH in an Auckland paper states that at Wellington £2,000 damages were awarded by a Christchurch jury to Mrs. Minnie Jones, whose husband was killed by electric shock while working on the North Canterbury Hospital roof; £1,000 for herself, and £250 for each of four children. The claim was for £2,500 against the North Canterbury Hospital Board.

BUSINESS NOTES.

City Business Men and Government Control of Trade.—Yesterday afternoon there was to be held at Cannon Street Hotel a public meeting of merchants, manufacturers and traders concerned in the production, importation, and distribution of commodities of national necessity. The object was to consider the effect of the present system of Government control of trade upon legitimate commercial interests. The following resolutions approving of the recommendations of the London Chamber of Commerce Merchants' Committee, which we reproduce from the *Financier*, were to be submitted:—

(a) That Government should cease to act as trading intermediary between producers and consumers, but should utilise to the fullest extent the services of the business community.

(b) That to this end merchants should be encouraged to continue to carry or import stocks of commodities essential to this country.

(c) That, so far as any control of imports and exports is concerned, the quantities allowed should as far as possible be based upon a fair allocation of quantities amongst merchants dealing in particular articles, after consultation with representative trade organisations. Permits should only be granted to British and Allied subjects who are legitimate merchants and importers to the trade involved.

(d) That the various control departments should be co-ordinated so far as to secure a uniform system on questions of principle and to obviate present delays in dealings with licences and permits.

(e) That control departments should in all cases be assisted by representative business men nominated by their respective trades.

(f) That steps be taken to represent to the Government, to Members of Parliament and the public generally the views set out in the report of this committee.

Basic Pig-Iron from Midland Ore.—The Right Hon. George Roberts, M.P., P.C., lit up on Saturday last the last remaining idle furnace at the Stanton Ironworks, which has been placed in commission for the purpose of making basic pig-iron out of local iron ore for steel making. The manufacture of basic pig-iron out of local ore is a new industry in the Midlands; and not until the shortage of raw materials for steel-making purposes had made itself felt were the Midlands called upon to divert their blast furnaces to the manufacture of basic iron. It is of interest to note that under normal conditions these furnaces remain in continuous operation for some 15 years before requiring relining. The Stanton Co. now have in commission nine furnaces, and supply their own iron ore and coal, &c.

Catalogues and Lists.—MESSRS. TREDEGARS, LTD., 9, Diana Place, Euston Road, London, N.W.1.—Leaflet giving prices, &c., of the "One Part" holder.

BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—List No. 4,155, giving description, dimensions and shipping particulars of oil-break switches, type O. Form E, also No. 4,153, giving similar information respecting Form C.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, London, W.C.—Thirty-six-page illustrated pamphlet, giving prices and essential catalogue details of "Sunlite P.E.", "Diffusa," Holophane, and other reflectors, and fittings for use with half-watt lamps, for lighting all departments of works and general offices, stores and tool-rooms, &c., also for yard, cinema and public building lighting.

MESSRS. COLE, MARCHENT & MORLEY, LTD., Bradford.—Twenty-four-page publication showing a large number of illustrations of condensing plants specialised in and installed by them.

MESSRS. SCHOLEY & CO., LTD., 56, Victoria Street, London, S.W. 1.—Leaflet fully describing the Copes feed-water regulators, for which the firm has recently booked a large number of orders. These include contracts with Sheffield (repeat order), Manchester and Birmingham Electricity Departments, the Yorkshire Electric Power Co. (repeat), Messrs. Babcock & Wilcox, and many industrial firms.

ELECTRICAL APPARATUS CO., LTD., Vauxhall Works, South Lambeth Road, London, S.W.—No. 4 of the E.A.C. "Quarterly Review," just issued, contains a good deal of illustrated material

relating to E.A.C. work in war time, and to the company's manufactures, such as an A.C. no-volt release, air compressors, springing figure type cyclometer counters for E.A.C. meters, controller regulators, testing rheostats, and automatic protection for slip-ring motors.

Liquidation.—British Continental Electricity Co., Ltd.—Creditors must send particulars of their debts, &c., to the Liquidator, Mr. C. E. Barker, 21, Finsbury Pavement, E.C., by November 30th.

Stoker Contracts.—The Underfeed Stoker Co. has effected sales of its stokers to the following electricity authorities:—

Wolverhampton Electricity Works	10 A
Brighton Electricity Works	6 A
Swansea Corporation Electricity Works	2 E
St. Helens Electricity Works	1 E
St. Albans Electricity Works	1 E
Carlisle Electricity Works	1 A
Bath Electricity Works	1 E

The latest list of customers for these stokers also includes the War Office, Messrs. Armstrong, Whitworth & Co., and a number of collieries, ironworks, &c.

Book Notices.—Science Abstracts, A and B. Vol. XX. Part 9. September 29th, 1917. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each.

"Letters concerning the War: Between an American and a relative in Germany." Privately printed, New York.

"Beama *Journal*." Vol. III. No. 4. October, 1917. London: Oakley House, Bloomsbury, W.C. Price 1s. net.

"Post Office Electrical Engineers' *Journal*." Vol. X. Part 3. October, 1917. London: H. Alabaster, Gatehouse, and Kempe. Price 1s. net.

LIGHTING AND POWER NOTES.

Acton.—The Council has received a cheque for £2,500 from the Metropolitan Electric Supply Co., in accordance with the terms arrived at when the Council disposed of its powers to the company.

The profit on the Acton undertaking was stated to be 10·26 per cent.; and having regard to this, the Council expressed the opinion that the company was not justified in increasing the charges for current by 10 per cent.

Australia.—Members of the Melbourne Council recently visited the Spencer Street power house, where a water-tube boiler has been equipped with a furnace for burning brown coal. The experiment is stated to be quite satisfactory, the full boiler output being maintained. It has been found that brown slack coal also gave good results; at present there is no market for this coal.

Blackpool.—Wages.—The War Bonus Sub-Committee has considered the application on behalf of the employés in the electricity works for a war bonus of 15s. week, and has decided to offer the same sum as was recently awarded workers in other departments—12s. a week. In the event of non-acceptance, the matter will go to arbitration.

The past six months' working of the Corporation electricity department shows an aggregate output of 2,649,261 units, an increase of 221,329 units on the similar period of last year.

Bolton.—Price Increase.—The Electricity Committee has approved a report submitted by the electrical engineer on the question of increasing the price of current owing to the increased cost of coal, and has decided that the following advance over the prevailing prices should take effect as from the commencement of the current quarter:—Ordinary power consumers, ·1d. per unit; lighting supply consumers, ·1d. per unit; and traction supply, subject to the approval of the B. of T., ·04d. per unit.

Bradford.—The latest establishments to adopt electricity for driving purposes are a new mill just completed for Messrs. Jeremiah Ambler & Sons, one of the pioneer woollen firms, and Dockfield Mills, Shipley, for the completion of which Government licence has been secured.

The Chamber of Trade has decided to support the National Chamber's petition to the Government (originated by the Leeds Chamber) for the fixing of definite uniform times of shop lighting restriction to cover the period of a month, during each month of the winter, based on the sunset conditions of the various parts of the country, instead of the present confusing system of a change of time every evening.

Bristol.—Year's Working.—The report of the year's working of the electricity department to March 31st last shows gross receipts amounting to £143,923, an expenditure of £98,348, and a gross profit of £45,574, which, with the amount transferred from redemption and sinking fund (No. 2) account, makes a total of £46,141. After repayment of loans and interest, £48,373, there was a net loss on the year's working of £2,232. The credit balance brought forward from last year's account was £9,292, which, with adjustment of income-tax (1915-16), £1,288, made a surplus of £10,580, which has been appropriated as follows:—Loss on year's working, £2,232; allowance to employés on active service, £3,308; and £4,968 on work not chargeable to loan account, leaving a balance of £72 to carry forward to next account. The outstanding debt amounts to £517,566. The total number of consumers was 5,736, a net increase of 128 during the year. The number of units sold was 23,579,139, an increase of 1,913,171. The general manager, Mr. H. Faraday Proctor, in his report states that the 3,000-kw. turbo-generator, sanctioned by the L.G.B. last year, had been delivered, and was expected to be in full running order during the autumn; but the load had so increased, that further plant was absolutely necessary. On the initiation of the Government scheme at Henbury, arrangements were made for co-operative working between the electric generating stations of the respective departments, with a view to the works of the Government being taken over by the Corporation after the termination of the war; the Government purchased a further 6,000-kw. generator in addition to those already on order for its own requirements for the more particular use of the Bristol Corporation Electricity Department to meet the growing demands. The stoppage of the works at Henbury had placed the Corporation electricity undertaking in a difficult position as regards meeting future requirements, as the Feeder Road station had its full complement of plant, and the Henbury scheme was being relied on. The engineer further states that arrangements for either the extension of the existing station at Feeder Road, or the construction of a new station on a large scale is therefore difficult, pending the advancement of the general scheme of organised electricity supply being considered by the Government, and it is particularly regretable that the purchase of the 6,000-kw. generator sanctioned by the Council in May, 1915, was not approved by the L.G.B., the added load having already almost taken up the capacity of the smaller set to which the Corporation was then limited by the Board. Of the £23,056 increase in working costs, £16,041 represented the additional cost of coal.

Ealing.—The T.C. has received a letter from the Commissioner of Police requesting the resignation of members of the electricity staff who had enrolled as special constables. The Town Clerk explained that this was the outcome of the Council's reply to a letter from the Commissioner respecting the payment of compensation for injury sustained in the course of duty by special constables enrolled for the purpose of protecting their employer's premises. The borough electrical engineer had applied for long-service badges for these men, but the request was refused. It was decided that the Town Clerk should point out that the men were enrolled three years ago, and that during that period the liability of the police authorities regarding the payment of compensation had not been questioned. It was also resolved to say that it would be an ungracious act to ask the men to resign at this juncture because the Council declined to accede to a demand which did not appear to be justified.

Greenock.—Proposed Loans.—The Corporation last week decided to apply to the Secretary for Scotland for sanction for power to borrow £55,000 for the electricity undertaking. It was stated that £6,000 was required to complete old contracts, £13,000 for additional mains and services in Greenock and £8,000 in Port Glasgow, £10,000 for land and property extensions at Dellingburn power station, and £16,000 for transforming plant and switchgear. The total of £53,000 will cover the immediate requirements, but in the near future further expenditure will be necessary.—*Glasgow Herald*.

Liverpool.—Output Figures.—The Corporation Electricity Department has made considerable progress during the past 12 months. There are now about 12,400 consumers, an increase of 400 in the year. Close upon 61,000,000 units were supplied for lighting, power and traction purposes, an increase of nearly 7 million units. During the first eight months of the present year there was an increase of 5 million units, or 13 per cent., as compared with a similar period last year.

London.—P.L.A. Report.—The report on the work of the Port of London Authority for the year to March last mentions that at the Royal Albert Dock 43 new electric cranes and a new crane track and conduit have been completed, and progress has been made with the provision of electric pumping plant for the dry docks.

At Tilbury three transit sheds, with 12 electric cranes, have been completed.

Loughrea.—The Town Commissioners decided to approach the Electric Lighting Co. with a view to the utilisation of electricity for the purpose of a new milling industry. Mr. Cahill said that after providing the town with light, something like 1,500 h.p. was being wasted, and might be turned to profitable account in the direction indicated. The L.G.B. has declined to sanction an increase from 6d. to 8d. per unit on electricity supplied by the company to the workhouse, stating that it does not consider the Guardians have power to increase the price agreed upon with the company in 1914.

Nuneaton.—Loan Application.—The T.C. has applied to the L.G.B. for sanction to a loan of £575 for money overspent on machinery, £785 for excess expenditure on mains and services, and £2,140 for new mains and services and costs of raising the loan.

Oldham.—Housing Schemes and Electric Lighting.—Acting on the request of the L.G.B., which has promised substantial financial assistance, local authorities in Lancashire, as elsewhere, are busy preparing big housing schemes to meet the great shortage which will exist in most districts after the war. This should mean a considerable extension of electric lighting. At Oldham there is a proposal to erect 500 houses, and at the meeting of the local Electricity Committee, Mr. Chamberlain, one of the joint engineers, stated that he had written to the borough surveyor, expressing the hope that the claims of the electricity department would not be overlooked when the question of the

means of lighting the proposed houses came to be considered. In the letter he pointed out that at present there were about 100 small houses, rented at about 5s. 6d. a week clear, which were electrically lighted. Mr. Chamberlain told the Committee that the old fetish that electric lighting was a matter for the big house only ought to have been dead long ago, and the present scheme, if carried out, would provide a splendid opportunity for that department.

Rochdale.—As a result of the extra cost of coal, the question of an increase in the charges for electricity is under consideration. There is now a coal clause in connection with the main contracts with consumers.

Southend.—Inquiry.—A L.G.B. inquiry was held on Tuesday, last week, regarding the proposal to borrow £45,520 for the provision of additional generating plant at the electricity works, and for £4,150 for electric vehicles for the collection of house refuse.

Tipperary.—The B. of G. proposes expending £400 on the renovation and improvement of the workhouse electric lighting plant.

TRAMWAY AND RAILWAY NOTES.

Australia.—Electrification of the Victorian Suburban Railways.—The Railway Commissioners have announced that, to enable the electric trains to be run during the first half of next year, special arrangements had been made to secure from America some of the gear necessary to inaugurate the service. The scheme had reached a stage where the installation of a small quantity of additional plant would allow trains to run on the Sandringham-Essendon line, and a relatively small portion of the rotary converting plant, transformers, and switchgear essential to the commencement of electric traction has been ordered from the General Electric Co. (U.S.A.), which is the contractor for the electrical equipment of the suburban rolling stock, and the original orders placed in Great Britain for the gear have been cancelled, so that no extra expense will be incurred by the transfer.—*Melbourne Age.*

Bingley (Yorks.).—The Council has decided to apply to the B. of T. for prolongation of the time by two years for the completion of the tramway at Crossflats. This step does not materially affect the proposed (after-war) linking-up of the Bradford, Bingley, and Keighley tramways between Crossflats and Stockbridge. It is an additional extension on the war-time extension already granted.

Birmingham.—Arterial Roads.—The City Council has adjourned consideration of the recommendation of the Public Works Committee favouring the widening of the chief arterial roads and the construction of a separate track system for tramways. The subject is to be discussed by the chief Committees of the Council, and there is good reason to believe that the scheme will again be submitted for adoption within the next three or four months.

Blackpool.—Year's Working.—The annual report of the Corporation tramways for the year ended March 31st last, shows a total revenue of £94,367, working expenses amounting to £53,229, and a gross profit of £41,138; interest and sinking fund charges absorbed £19,956, leaving a net profit of £21,182, which has been disposed of as follows:—For the relief of rates, £10,000; permanent way renewal fund, £9,000; to reserve fund, £2,182. The total amount at the credit of the reserve fund is now £9,142, and of the renewals fund £30,542. The passengers carried numbered 17,810,538; the car-mileage was 1,131,728, showing an increase of 3,224,687 passengers and 62,204 miles during the year. The average total revenue per car-mile was 20·01d.; the average working expenses per car-mile, including power, were 11·29d.

At a meeting of the Tramways Committee, Mr. Charles Furness, general manager, reported that when conditions allowed he should apply for permission to purchase about 16 additional cars, bringing the total up to about 100. At the same time he recommended, in view of depletion of staff, that application be made to the B. of T. for permission to use trailer cars. This would increase the carrying capacity from 50 to 80 per cent., and only an additional conductor would be required. The Committee approved the recommendation, and application is to be made as suggested.

A recommendation by the Watch Committee that a double set of lines should be placed at the Dickson Road terminus of the Blackpool and Fleetwood Tramroad Co., was deferred until the present lease expires in July, 1919.

Bradford.—Wages.—The Corporation tramway workers, numbering about 1,000, through the local branch of their Union, are applying for a wages advance of equal to £1 per week on pre-war rates. They are already in possession of advances up to 12s. per week in addition to receiving time and a-half pay for overtime. The new demand would cost the department £42,000 a year. The Tramways Committee states that the advance is impossible without a material increase in fares. The Committee has recommended to the War Wages Committee that the application be not granted, but it is willing to go to arbitration.

Traffic Returns.—The city's tramway receipts for the half-year ending September 30th were £203,590, an increase of £19,000 on the corresponding period last year. The total expenditure includes £22,000 in war wages and bonuses, an increase of £14,000, in addition to which, £10,000 (an increase of £4,000) has been paid in war allowances. The car-mileage was 3,052,000, a decrease of 107,000. The passengers carried numbered 42,893,000, an increase of 745,000, averaging 127 journeys for the whole population, an increase of 16 journeys.

Continental.—Switzerland.—The Swiss Locomotive and Machinery Works Co., of Winterthur, which has just declared a dividend of 7 per cent. for 1916-17, as in the previous year, reports that the Federal Railway Administration has definitely allocated to the company an order for the mechanical parts of the four experimental electric locomotives for the St. Gothard Railway.

Edge Hill Light Railways.—An application was recently made to the Light Railway Commissioners for an order authorising various lines in the district between Stratford-on-Avon and Banbury, covering about 11 miles. The railways are to deal with minerals, though passenger-carrying powers are included; it is apparently intended to adopt electric traction, as powers are sought for the erection of a generating station.

Huddersfield.—Wages.—The existing war bonus of 10s. per week paid to adult male tramway employés is increased to 14s. per week; those of the female employés (4s. 6d.) and boys (5s.) are increased by 2s. each, with certain conditions as to overtime work. The increased bonuses are retrospective to September 19th.

Lancashire.—Tramway Wages Award.—The recent award to the tramway workers of Lancashire is now being regarded as even more favourable to the employés than was at first apparent. The arbitrator, on a point of appeal, has decided that the award of 12s. for men and 9s. for women applies to a six-day working week, and that if an employé works seven days he is entitled to an extra amount. As, owing to the reduction in staffs, the seven-day week is fairly general, this will mean an increase of 14s. a week. In Bolton, where a 13-day fortnight arrangement has been in vogue, the general manager has been authorised to prepare a scheme for a six-days' week.

Liverpool.—The Corporation Tramways have carried nearly ten million more passengers during the past nine months as compared with 1916, and although there was a decrease in the mileage run of 90,303 miles, the receipts, which were £603,317, showed an increase of £53,417 upon those of the corresponding period of last year. The earnings per car-mile were 1s. 3·43d., as against 1s 3·88d. Some 2,200 employés have joined the Forces, and this fact, with the difficulty of obtaining supplies, has involved strenuous conditions.

London.—The Lewisham B.C., having regard to the improving receipts of the L.C.C. tramways, has directed that they should be included in a provisional valuation list for reassessment.

Londonderry.—A member of the Corporation having declined to negotiate with that body for the use of land in connection with the proposed city electric tramway service, the Corporation decided to acquire the land compulsorily.

Warrington.—The T.C., in sanctioning increased fares on the tramways, was told by Alderman Wilkinson that war bonuses were costing the Corporation £3,600 a year. Prior to the war, in 1914, the working cost per car-mile was 8d., and they could make money on that basis, but the cost had now risen to 11¼d. per car-mile.

TELEGRAPH AND TELEPHONE NOTES.

Argentina.—The high-power wireless station which, with the consent of the Argentine Government, has been erected, under the supervision of Messrs. Siemens-Schuckert, in the vicinity of the station of Plomer is designed to communicate with the high-power station at Nauen, near Berlin, the distance between the two stations being about 13,000 kilometres. Signals from Germany have already been received, but the prevalence of strong atmospherics has so far prevented them from being intelligible.—*Review of the River Plate.*

Australia.—Orders aggregating 1,000 lines of automatic central-office equipment and 1,000 telephones equipped with the dial have just been placed, to be used as additions to the automatic exchanges in Australia. This is the second set of orders placed since the beginning of 1917, the first one—for 1,800 lines—being received in February.—*T. and T. Age.*

The Minister for the Navy recently stated that £55,000 had been spent in the purchase of wireless workshops and plant at Randwick, Sydney, and there were now 81 men employed there.—*Melbourne Age.*

Holland.—In confirmation of the report that there is wireless communication between Holland and foreign countries, *via* Berlin, the Amsterdam *Telegraaf* states that commercial telegrams are arriving in Holland by this route.—*The Times.*

Telephoning During Air Raids.—The Postmaster-General earnestly appeals to the public to refrain from using the telephone during and immediately after an air raid. Private calls must necessarily give way at such times to urgent calls of public and national importance.

CONTRACTS OPEN AND CLOSED.

OPEN.

Dublin.—November 1st. G.N. Railway Co. (Ireland). Six or twelve months' supply of general stores (including several electrical items). See "Official Notices" October 5th.

Grimsby.—October 29th. Corporation. House service boxes and house fuse-boxes and fittings. See "Official Notices" October 12th.

Spain.—The municipal authorities of Urueña (Province of Valladolid) have just invited tenders for the concession for the electric lighting of the town during a period of 15 years. Tenders have also lately been invited by the municipal authorities of Villadefrades, in the same province, for the concession for the electric lighting of the town during a similar period.

York.—November 2nd. N.E. Railway. Telegraph stores for six and twelve months. See "Official Notices" to-day.

CLOSED.

Government Contracts.—List of new contracts placed during September, 1917 :—

WAR OFFICE.

Generating sets.—B. A. Lister & Co., Ltd.
Motors.—Electric Construction Co., Ltd.; F. Parkinson & Co.; Rhodes Motors, Ltd.
Transformers.—Harland Engineering Co.
Iron wire.—Dorman, Long & Co., Ltd.; Firth & Co., Ltd.; Guest, Keen and Nettlefolds, Ltd.

INDIA OFFICE STORE DEPARTMENT.

Alternators.—Crompton & Co.
Cells.—Siemens Bros. & Co.
Cells and dynamos.—J. Stone & Co.
Copper plates.—Williams, Foster & Co.; Pascoe, Grenfell & Son.
Gutta-percha sheet.—Siemens Bros. & Co.
Wire.—Whitecross Co.; Shropshire Iron Co.; R. Johnson & Nephew.

H.M. OFFICE OF WORKS.

Engineering services.—Electric wiring, &c., new Court House, Newington Causeway: Lund Bros. & Co.
Ordnance Survey Office, overseas.—Electric generating plant: Harland Engineering Co.

POST OFFICE.

Telegraph apparatus.—Automatic Telephone Mfg. Co., Ltd.; General Electric Co., Ltd.; I.R., G.P. & Telegraph Works Co., Ltd.; Telegraph Condenser Co., Ltd.; H. White & Co.
Telephone apparatus.—British L. M. Ericsson Mfg. Co., Ltd.; General Electric Co., Ltd.; Western Electric Co., Ltd.
Submarine cable.—Telegraph Construction and Maintenance Co., Ltd.
Telegraph cable.—Connolly Bros., Ltd.
Telephone cable.—B.I. & Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; W. T. Glover & Co., Ltd.; Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; C. Macintosh & Co., Ltd.; Peel-Conner Telephone Works, Ltd.; Siemens Bros. & Co., Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Leclanché cells.—Siemens Bros. & Co., Ltd.
Insulators.—Bullers, Ltd.
Stay-rods.—Bayliss, Jones & Bayliss, Ltd.
Zinc rods.—Eyre Smelting Co., Ltd.
Bronze wire.—B.I. & Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. and Smiths, Ltd.).
Copper binding wire.—B.I. & Helsby Cables, Ltd.
Covered copper wire.—Concordia Electric Wire Co., Ltd.
Copper line wire.—T. Bolton & Sons, Ltd.; B.I. & Helsby Cables, Ltd.; Elliott's Metal Co., Ltd.; Johnson & Nephew, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. & Smiths, Ltd.); Wilkes, Sons & Mapplebeck, Ltd.
Voltoids.—Brunner, Mond & Co., Ltd.

London.—ST. PANCRAS.—The Borough Council has accepted an offer of Messrs. Bruce Peebles & Co. to supply an additional 1,000-KW. motor-converter for £4,000.

HAMMERSMITH.—The Electricity Committee recommends that the offer of Messrs. W. B. Dick & Co., Ltd., be accepted for the supply of cylinder oil for 18 months from September 25th, 1917, at 3s. 6d. per gallon.

Taunton.—T.C. 2,500 tons of Russell's Black Vein washed bean coal for the electric light works: Cory Bros. & Co., Ltd., at £1 9s. 9d. per ton, an advance on the last contract of 7½d.

Transformer and Meter Contracts.—Messrs. Ferranti, Ltd., have received the following contracts :—

Yorkshire Electric Power Co.—One 150-K.V.A. and one 200-K.V.A. 3-phase transformer.
British Cellulose & Chemical Mfg. Co., Ltd.—Three 10,000-K.V.A. 3-phase transformers for furnace work (secondary current 50,000 amps.).
Stockton-on-Tees Corporation.—Annual contract for C.C. meters.
Redditch Urban District Council.—Annual contract for A.C. meters.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, October 26th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on "A Class of Multiple Thin Objectives," by Mr. T. Smith, and on "The Radius of the Electron and the Nuclear Structure of Atoms," by Prof. J. W. Nicholson.

Association of Supervising Electricians.—Tuesday, October 30th. At 7.15 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "Switchboard Telephone Equipments," by Mr. T. P. Lee.

Salford Technical and Engineering Association.—Saturday, November 3rd. At 7 p.m. At the Royal Technical Institute, Peel Park. Members' short papers for gold medal given by Mr. W. O. Larmuth.

NOTES.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel Clay, V.D., commanding :—
Officer for the Week.—Lieut. W. J. A. Watkins.
Drills.—Week ending Sunday, November 4th, 1917 :—
Monday.—No. 3 Company, Left Half. Recruits, signalling, 6.30.
Tuesday.—Physical drill and bayonet exercise, 7.30.
Wednesday.—No. 1 Company, 6.30.
Thursday.—No. 2 Company, 6; signalling, ambulance, 6.30.
Friday.—No. 3 Company, Right Half. Recruits, 6.30.
Sunday.—Commandant's Parade. Parade Waterloo Station, opposite No. 10 Platform, 8.45 a.m., for work at Esher. Uniform. Mid-day rations to be carried. Compulsory for A and B men.
Musketry.—Belvedere Road. Tuesday, Wednesday, and Thursday, 5.30 to 7.
Note.—The Medical Officer will attend for examination of recruits, &c., on Thursday, at 6.
All enamelled cap badges must be returned to the Quartermaster-Sergeant without delay.
The Regimental Tailor will attend on Tuesday, October 30th, at Headquarters, at 6.30, to measure for uniforms.
Unless otherwise indicated, all drills will take place at Headquarters.

(By order) MACLEOD YEARSLEY, *Capt. and Adjutant.*

Metropolitan Association of Electric Tramway Managers.—A meeting of the members of this Association was held at the Municipal and County Club, Whitehall, on Friday last, when there were present :—Messrs. Ullmann (East Ham), Harvey (Ilford), Hammond (Met. Electric), Williams (Erith), Stokes (Bexley), Mason (South Met.), Mackinnon (L.U.T.), and Goodyer (Croydon). Messrs. Ullmann, Hammond and Goodyer were respectively re-elected chairman, vice-chairman and secretary. A number of items on the agenda had to be left over for discussion at a subsequent meeting.

Municipal Trading: Our Obligations to Posterity.—The following is an extract from the report of the chairman of the Christchurch (New Zealand) Municipal Tramway Board for the year ending March 31st, 1917 :—"Some day the New Zealand Legislature may recognise the advisability, in view of the rapid increase in municipal trading concerns, of setting up a standard, as the result of the fullest investigation, for the guidance of those municipalities which desire to strike a true balance between the rival interests of the present generation, which wants to get as many benefits as possible from its municipal trading concerns, and the coming generation, which, while undertaking its own new burdens, should not receive, by way of legacy, obligations which should have been met by its forefathers."

Appointments Vacant.—Chief assistant engineer, for the Fleetwood U.D.C. electricity works, £150; mains engineer (£3) for the Lowestoft Corporation electricity and tramways departments; shift engineer (£220) for the Manchester Corporation electricity department; assistant electrical engineer for the Buxton Corporation electricity undertaking; charge engineer (50s.) for the L.C.C. Tramways Department; meter repairer (45s.) for the Luton Borough Electricity Works. See our advertising pages to-day.

Central Station Employes: St. Pancras Proposals.—In view of the general increase of wages throughout the country to employés engaged in electrical undertakings, the St. Pancras Borough Council has secured information regarding the rates paid by other municipal undertakings, and, as a result, the Electricity Committee makes the following recommendations :—

	Present maximum weekly wages.	Revised maximum weekly wages as recommended.
Station superintendent (King's Road)	£208 + 25 & 17 = £250 per annum; present salary £230 per annum	To receive maximum salary of £250 forthwith, instead of on Dec. 16th next, when it becomes due.
Chief assistant (Regent's Park)	£3 10s. per week	£200 to £205 per annum, paid monthly.
Shift engineers (King's Road)	£3 0 0	£3 15 0
Shift engineers (Regent's Park)	2 10 0	3 5 0
Sub-station electrician	2 0 0	2 12 6
Switchboard attendants	1 10 0	2 0 0
Engine drivers	2 0 0	2 7 6
Condenser hands	1 12 6	2 0 0
Cleaners	1 10 0	1 15 0
Boiler foremen	2 5 0	2 10 0
Stokers (per shift)	5s. 3d. per shift	6s. 6d. per shift.
Trimmers	4s. 4d. per shift	5s. per shift.
Storekeeper (King's Road)	£1 17 6	£2 0 0
Storekeeper (Regent's Park)	1 15 0	1 17 6
Mains superintendent (out-doors)	4 10 0	No alteration.
Mains superintendent (in-doors)	4 0 0	No alteration.
Meter and installation superintendent	(Vacant)	——
Meter and installation assistant	£2 5 0	£2 10 0
Meter repairer	2 0 0	2 5 0
Meter inspector and repairer	1 17 6	2 2 6
Meter exchangers	1 12 6	1 17 6
Boys, 14—18 years of age	0 10 0	10s. to 15s.
Youths, 17 years and upwards	1 5 0	£1 to £1 5s.
Improver	1 7 6	£1 to £1 7s. 6d.
Carpenter	2 5 0	£2 10 0
Storekeeper (mains department)	1 15 0	1 17 6
Arc lamp foreman	2 2 6	2 10 0
Assistant arc lamp foreman	2 0 0	2 5 0
Arc lamp trimmer	1 15 0	1 17 6
Arc lamp repairer	1 15 0	1 17 6
Cable jointer (sen.)	2 5 0	2 10 0
Cable jointer	2 2 6	2 7 6
Cable mates	1 12 6	1 17 6
Gangers	1 17 6	2 2 6
Manhole inspector	1 12 6	1 17 6
Wireman, first	2 0 0	2 5 0
Wireman, second	1 15 0	2 0 0

Inquiries.—Makers of machines for the manufacture of litharge perforated lead sheet and moulding lead grids for accumulators are asked for.

Institution and Lecture Notes.—Belfast Association of Engineers.—The new session opened last night (Thursday) with the presidential address of Mr. A. M'I. Cleland on "The Relations between Employer and Worker." Other events in the programme are :—

December 20th.—"Electro-Metallurgy," G. L. Roslyn.
January 17th, 1918.—"Past, Present, and Future of the Internal-combustion Engine," Prof. J. H. Smith, D.Sc.
February 21st.—"Decimal System," Dr. W. J. Crawford.
March 21st.—"The Panama Canal," J. Milne Barbour, D.L.

Institution of Engineers and Shipbuilders in Scotland.—The report of the Council for the year ending on September 30th, 1917, shows that the membership was 1,573, a decrease of 20 members. The income was £3,536, and the expenditure £3,413, leaving a surplus of £123.

Greenock Electrical Society.—The opening meeting of the session took the form of a whist drive in aid of Red Cross funds on October 18th. The honorary president, Mr. Hugh Ferrier, gave a short address on "Technical Education."

Manchester Association of Engineers.—At the first meeting of the session, on October 13th, the president, Mr. J. P. Bedson, delivered an address in which he referred to the mineral riches of Alsace-Lorraine, Belgium, and the North of France, which Germany desired to secure; and afterwards dealt with the importance of unified control of all transport facilities in this country. As an instance of what the British manufacturer was up against in the matter of transport cost, he said that before the war Belgian nail-makers, buying their rods in Germany, 400 miles from their own works, could get them delivered for 1s. 6d. per ton by water, and could deliver into the Thames for 5s. per ton, a total of 6s. 6d. per ton, whereas delivery from Manchester would have cost at least 15s. per ton. The cost of railroad transport in this country was 1·192d. per ton per mile, as compared with France 0·726d., Germany 0·637d., Holland 0·590d., Norway 0·867d., and Denmark 0·956d., the main reason for the high cost of transport in this country being our neglect of water transport. Canal and river transport on the Continent had been developed to a remarkable extent. The ton-mile traffic on the Rhine alone was 4,025,660,000, that on the Elbe 2,222,080,000, on the Seine 610,000,000, on the St. Quentin 291,075,000, and on the Scheldt 177,673,000. To reach that level in this country he imagined State aid would be necessary, and, should a Ministry of Commerce be appointed, the State might be led to realise that our canals should be improved, utilised, and nationalised at the very earliest moment: in fact, they should be made free, on the same principle as highways.—*Colliery Guardian.*

Institution of Electrical Engineers.—The opening meeting of the 1917-18 session will be held on Thursday, November 8th, at 6 p.m., preceded by light refreshments at 5.30 p.m. Mr. C. H. Wordingham will deliver his inaugural address, and the premiums will be presented. By kind permission, the meeting will be held at the Institution of Civil Engineers, Great George Street, S.W.

Lancashire and Cheshire Linking-up Scheme.—The question of the linking-up of Lancashire and Cheshire electricity undertakings is to be further discussed at a conference which is to be held in Manchester next month. The second report of the Inter-connection Committee will be considered, and opposition will then be forthcoming from several of the authorities interested in the suggestion contained in the report, that the Joint Board shall be invested with powers to acquire, when and where necessary, the ownership and control of existing power stations.

A meeting of "Group C" has been held at Stalybridge, at which there were present representatives from the boroughs of Ashton-under-Lyne, Oldham, and Stockport, the Stalybridge Joint Electricity Board, and the Glossop Electric Lighting Co. After full discussion of the report, it was unanimously decided to express agreement generally with the proposals for linking-up the electricity undertakings in the Lancashire and Cheshire area, but stating disagreement with that portion of the report which refers to the conferment of additional powers upon the proposed Joint Board in regard to the establishment and control of all future and existing power stations and high-pressure transmission lines. The view was expressed that the idea of supplying the whole of the district concerned with current produced from one central generating station would probably mean an increase in the price for lighting, and certainly an increase in the price of current for power purposes.

Reference to the matter was made at a recent meeting of the Oldham Corporation Electricity Committee. Coun. Jackson said that the price at which it was proposed to supply current under the scheme was in excess of the figure at which Oldham were able to supply at present; in fact, the proposed price was a farthing per unit higher than Oldham's charge. The idea of linking-up electricity stations was all right, but he took exception to that part of the scheme which might simply reduce the Oldham works to the level of a distributing station. Coun. Frith said that the biggest difficulty they had was the fact that they could not buy machinery. When the war was over, and they could get the requisite plant, they would be able to supply current cheaper than at present, and at a rate that would be far less than that proposed under the centralised scheme, which he thought was altogether too big to be workable.

British Dyes, Ltd.—In the annual report it is stated that the electrical installation has been completed, and both the old and new works are now entirely operated by the company's own plant. A power gas plant has been completed, and is in operation. A pipe system for the distribution of gas, steam, and compressed air throughout the works is approaching completion.

The Association of Electrical Station Engineers of London.—The following letter has been received by this Association from the Chief Industrial Commissioner's Department, Ministry of Labour, Whitehall, S.W., by the Association :—

"With reference to your letters of the 19th and 20th inst., I am directed by Sir George Askwith to say that, so far, no agreed conference has taken place. Such a conference is only being arranged between the parties, and he would suggest that you should communicate with Mr. Edward Calvert, Hon. Sec., Associated Municipal Electrical Engineers, Electricity Works, Squire's Lane, Finchley, with a view to being represented at the conference."

Accordingly, the hon. secretary of the Association, Mr. W. A. Jones, A.M.I.E.E., wrote to Mr. Calvert as follows, on October 22nd :—

"re Conference between the A.M.E.E., E.T.U., and Representatives of London Borough Councils.

I beg to enclose herewith a copy of a letter from the Chief Industrial Commissioner with respect to a claim made by this Association to represent power station engineers-in-charge and technical assistants at the above conference.

I enclose a list of the London power stations, the staffs of which are represented by this Association. Such further information as you may require to substantiate the claims made by this Association I shall be pleased to supply.

In view of the close proximity of the commencing date of the conference, I shall be glad to receive your assurance, at the earliest possible moment, that facilities will be granted for this Association to be represented."

We are informed that a circular is being addressed to the London power stations in the terms given below :—

A representative Committee with executive powers has been formed to deal with the following matters :—

1. All questions arising out of and in connection with the conference between the A.M.E.E. and E.T.U. under the presidency of Sir Geo. Askwith.

2. To plan the reconstruction of the London division of the above Association.

The constitution of the Committee is as under :—

Chairman : Mr. H. W. Healy (Battersea).

Hon. Sec. : Mr. Arthur Jones, A.M.I.E.E. (Leyton).

Committee : Mr. E. N. Christmas (Islington); Mr. C. Cox (L.N.W. Railway, Stonebridge Park); Mr. W. Willcocks (Hammersmith); Mr. A. J. Giffin (West Ham).

Pending the full development of the reconstruction, of which you will receive notification in due course, three geographical divisions have been created, viz. :—West; North Central; East.

The appended tabulation will clearly indicate this sub-division, together with the officers acting for each division.

West.	North Central.	East.
Mr. H. W. Healy (Battersea).	Mr. J. Cox (L.N.W.R., Stonebridge Park).	Mr. A. Giffin (West Ham).
Mr. Willcocks (Hammersmith).	Mr. E. N. Christmas (Islington).	Mr. W. A. Jones (Leyton).
	Stations.	
Acton.	City of London.	Barking.
Battersea.	County of London (City Road).	Beckenham.
Barnes.	Central Elec.	Bermondsey.
Brompton and Kensington.	Finchley.	Blackheath S. Met.
Chelsea.	Hackney.	Bow (C.X. and City).
Chiswick.	Hampstead.	Dartford.
Croydon.	Hornsey.	Deptford.
Ealing.	Islington.	Erith.
Fulham.	Lambeth (South London).	East Ham.
Heston and Isleworth.	Neasden (Met. Rail.).	Ilford.
Kingston.	St. Pancras.	Leyton.
Kensington and Knightsbridge.	St. Marylebone.	Poplar.
Lots Road.	St. James' and Pall Mall.	Stepney.
Twickenham.	Westminster Elec. S.	Southwark.
Wandsworth.	Watford.	Shoreditch.
Wimbledon.		Walthamstow.
Wimbledon (L.S.W. Railway).		West Ham.
Willesden (North Met.).		Woolwich.

All inquiries concerning the Association should be directed to the officers in control of your division.

Membership of the Association embraces the following grades of engineering assistants :—

Engineer-in-charge.	Meter superintendents.
Assistant engineer-in-charge.	Draughtsmen.
Junior in-charge.	Testing engineers.
Mains assistants.	Publicity engineers.

The Association at present includes in its membership a number of senior technical or administrative officers. Engineers holding this rank are invited to communicate direct with the Hon. Sec., Mr. W. Arthur Jones, A.M.I.E.E.

Applications for membership will only be considered from fully qualified engineers, and should be made direct to the officers in control of your division.

H. W. Healy (*Chairman of Committee*).
W. A. Jones, A.M.I.E.E. (*Hon. Sec.*).

Engineering Training.—Yesterday afternoon a meeting was to be held at the Institution of Civil Engineers, to form a Central Organisation for improvement in and better co-ordination of engineering training, and to appoint a representative committee of engineering and educational interests to initiate action in the matter. The proposal arises out of an informal conference of engineers and educationalists, which held several meetings at the Board of Education early this year.

The conference presented a memorandum to the Board suggesting that a bureau might be established within the Department, and the suggestion received strong support from professional men, accompanied, however, by an expression of opinion that an independent organisation would be preferable. Mr. Fisher, President of the Board, agreed with this view, and the meeting was accordingly convened. A report will appear in our next issue.

Engineering in China.—At the Engineers' Club, Manchester, on Tuesday evening, Mr. S. W. B. McGregor, who for some years represented a group of British manufacturing engineers in Shanghai, opened a debate on "The Commercial Aspect of Engineering in China."

Late Legal.—Osram Lamp Works *v.* Pope's Electric Lamp Co.—Yesterday, by a majority of three to two, the House of Lords decided the above case in favour of the Osram-Robertson Lamp Works, Ltd., with costs.

OUR PERSONAL COLUMN.

Central Station and Tramway Officials.—The Preston Corporation Tramways Committee recommends the appointment of Mr. Henry Clayton as assistant engineer and manager at £200 a year.

The Electricity Committee of St. Pancras Borough Council recommends that the salary of Mr. T. W. Merry, superintendent at the King's Road Station, be increased from £233 per annum to the maximum of £250 per annum forthwith.

Blackpool Electricity Committee has appointed Mr. George Yates electrical fittings superintendent at £200 per annum, rising by annual increments of £25 to £250; Mr. Herbert Makin to be salesman and chief clerk, at £180, rising by £10 to £200; Mr. Walter Unsworth to be invoice and ledger clerk, at £150, rising to £160 at the end of 12 months; and Mr. F. W. Leatherbarrow to be stores clerk in the electricity department at £135, rising to £150.

Barnes U.D.C. has increased the salary of Mr. Cornet, shift engineer at the electric light works, from £160 to £180 a year, and his war bonus from £16 to £18 per annum.

General.—Mr. E. W. Flower has resigned the office of president of the Federated Electrical Trades Union of Australia (N.S.W. Branch). In his letter to the Union, which is prominently published in the Australian Press, he says:—

> The obligations which I have taken, and which are numerous, are of such a character that I feel I cannot allow myself to be associated any longer with this strike. I have endeavoured to remain loyal to my Union at all times, and I trust I have proved so, but the conditions of my country compel me at this hour to do that which is lawful and right. I cannot consider my case for one hour longer; I am determined, and would ask you to accept this forthwith.

Mr. Flower has resumed duty in the railway department.

On October 22nd a presentation was made to Mr. Malcolm Breingan, manager of the Glasgow branch of the Western Electric Co., Ltd., by friends in the electrical trade on the occasion of his approaching marriage. The presentation took the form of a handsome salver, uniquely decorated with facsimile initials of the donors.

Mr. G. W. Tempest, chief engineer for the Lancashire and Yorkshire Private Telephone Co., Manchester, has been married at Heptonstall (Yorks.) to Miss Ethel Sutcliffe. From his employers, Mr. Tempest received a cheque and dinner service.

At Manchester, on Saturday last, the wedding was solemnised of Miss Vera Ferranti, daughter of Dr. S. Z. de Ferranti, of The Hall, Baslow, and Lieutenant Erling Ord, Canadian R.A.M.C., who holds the Croix de Guerre. Lieutenant Ord attended the bride's brother, Major Ferranti, who died of wounds in July, while he was in hospital, and he was entrusted with the late Major's last message home. It was in this way that he first met the lady who is now his wife.

At Brantford, Ontario, according to the *Times*, the Duke of Devonshire unveiled a monument to Dr. Alexander Graham Bell, inventor of the telephone. Dr. Bell and Mrs. Bell were present. Dr. Bell's first successful experiment was made in Brantford in 1874, and the Bell Homestead of 13 acres has been acquired by the Bell Memorial Association.

Roll of Honour.—Captain Desmond Gardiner Trouton, R.F.A., who, according to the *Times*, was killed on October 13th, took a degree in electrical engineering at University College, London.

Sergeant D. Livingstone, R.F.A., who has fallen in action, was with Messrs. Richardsons, Westgarth & Co., of Hartlepool.

Private D. L. Prest, Durham L.I., who was on the staff of Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool, has been wounded in action.

Corporal R. A. Knight, R.E., who has fallen in action, was on the staff of Mr. W. Rigden, electrical engineer, of Ramsgate.

Lance-Corporal F. Anderson, of the Croydon Corporation tramway staff, has died whilst on active service.

Corporal A. C. Pearce, R.E., an overhead linesman on the Corporation tramways at Croydon, has been awarded the Military Medal.

Sapper J. F. Bagnall, R.E., awarded the Military Medal for bravery in maintaining telephonic communication under heavy shell fire, was on the staff at Siemens Bros. Dynamo Works, Stafford.

Private W. F. Webb, City of London Regiment (P.O. Rifles), killed in action, was a meter inspector in the Winchester Corporation electricity department.

Second-Lieutenant W. G. Mansell, 3rd East Surrey Regiment, attached to the R.F.C., reported missing, and feared killed, was, on the outbreak of war, an electrical engineering student at the Battersea Polytechnic.

The Military Medal has been gained by Company Sergeant-Major Underwood, Royal Welsh Fusiliers, an inspector on the Mansfield & District Light Railways. On September 13th last he led a raid on the enemy trenches, and was instrumental in getting in all the wounded.

Private W. Bruford, who has died from wounds, was employed by Messrs. Dick, Kerr & Co., Ltd., Preston.

Private S. Henshall, of the Coldstream Guards, who has been killed in action, was employed by the Lancashire Electric Power Co.

Private E. Hall, Manchester Regiment, who died of wounds on October 10th, was employed by the British Westinghouse Co., Ltd., Trafford Park.

Sapper F. Smith, R.E., who was wounded in France a fortnight ago, was employed in the Accrington Corporation electricity department.

Private R. Sumner, severely wounded, was head clerk for the Alderley & Wilmslow Electric Supply Co.

Lance-Corporal J. Walmsley, L.N.L. Regiment, and Sapper R. C. Bond, R.E., both employés of Messrs. Dick, Kerr and Co., Ltd., Preston, have been killed in action.

Sergeant W. Palframan, holder of the D.C.M. and two Certificates of Merit for bravery in action, who was a former employé of the Bradford tramways department, was presented to the Tramways Committee last week whilst on leave. A resolution of hearty congratulation was accorded him.

Gunner R. Bonworth, R.F.A., who has died of wounds in France, aged 43, was employed by Messrs. Whipp & Bourne, electrical engineers, Castleton.

Private T. Cook, King's (Liverpool) Regiment, killed in action, was employed by Messrs. Dick, Kerr & Co., Ltd., Preston.

Sergeant J. Doyle, recently awarded the Military Medal, has since died of wounds. He was for many years before enlistment a motorman on the Liverpool Corporation tramways.

Corporal P. Whiteside, R.F.C., who has been wounded, was an apprentice electrician with the Lancashire & Yorkshire Railway Co.

Private A. E. Good, Oxford and Bucks. L.I., who has fallen in action, was employed by the Electric & Ordnance Accessories Co., Aston.

Corporal E. P. Moore, Machine Gun Section, formerly employed in the electrical laboratory of the B.T.H. Co., Rugby, has been killed.

Second-Lieutenant H. V. Schofield, who received his early training as an electrical engineer at the Whitby U.D.C. electricity works, has been appointed Adjutant of his Brigade, and will assume the acting rank of Captain.

Sapper J. Maughan, a Leeds electrical engineer, has been admitted to hospital suffering from trench fever.

Lance-Corporal W. Killin, Seaforth Highlanders, killed in action on October 12th, was employed by Messrs. C. Macintosh & Co., Ltd.

Sergeant J. Seazel, R.A.M.C., who has fallen in action, was formerly in the employ of Messrs. Messengers & Sons, electric lamp manufacturers, Birmingham. He had been recommended for the Military Medal.

The *Times* reports that Lieutenant (late Acting Captain) J. H. Cardew, M.C., R.F.A., died of wounds on October 5th. He graduated with honours, specialising in electrical science, at the McGill University, Montreal. He was trained as an electrical engineer at the British Westinghouse Works, where he was captain of the Westinghouse Football Club. He entered the Indian Government service in 1909, and at the outbreak of war held the appointment of electrical engineer of the Oudh and Rohilkund and North-Western State Railways.

Obituary.—Mr. H. A. Wrottesley Fanshawe.—The death occurred in London, on October 18th, of Mr. H. A. Wrottesley Fanshawe, late of the Indian Government Telegraphs, at the age of 70 years.

Mrs. M. Longridge.—We regret to learn from the *Times* "Deaths" columns that Mrs. Michael Longridge has passed away in South Devon, at the age of 70 years. We desire to tender an expression of sympathy to Mr. Michael Longridge, President of the Institution of Mechanical Engineers, in which expression, we believe, we shall carry with us the feeling of a wide circle of friends and admirers.

Mr. J. J. Kirkham.—The death took place on October 15th of Mr. Joseph John Kirkham, manager of the works of the Deal and Walmer Gas & Electricity Co. He had held this position for 21 years.

CITY NOTES.

Dick, Kerr and Co., Ltd. The report for the year ended June, 1917, states that the profits earned were £95,465, to which is added £20,397 brought forward. After paying debenture interest, trustees' fees, and premium on debenture stock redemption, the balance is £105,374. Six per cent. has been paid on the preference shares, 10 per cent. is recommended on the ordinary shares, £25,000 has been put to supplement special reserve for contingencies, and £36,074 is to be carried forward. The amount of excess profits levy has not been finally settled; the reserves are sufficient for extra depreciation, special taxation, &c. The work carried out by all departments on behalf of the Government has been of even greater magnitude than in the preceding year. The national factory mentioned in last year's report has been completed and organised, and was handed over to the Government as a going concern in July, thus releasing a number of members of the staff of the company for new development work in other directions. The company has acquired the control of the United Electric Car Co., Ltd., by the purchase of the greater part of the issued preference and ordinary shares of that company. Steps have since been taken to amend the Articles of the Car Co. so as to enable Dick, Kerr & Co. to retain control of that company so long as it continues to hold the ordinary shares, and the directors, therefore, intend to dispose of the preference shares so as to replace the capital of the company temporarily invested therein. Before offering the shares for sale elsewhere, the directors are inviting applications for them at par from share and debenture holders of D.K. & Co. The output of the Car Co. will be sold through D.K. & Co.'s selling organisation, and it is anticipated that a considerable increase in business and reduction in general and administrative expenses will result. Annual meeting: London, Oct. 31st.

Erinoid, Ltd. The second annual meeting was held in London on October 18th. The chairman, Mr. Andrew Binnie, moved the adoption of the report, which recommended a dividend equal to 16¼ per cent. per annum. For 1915 the trading profits were £5,825, for 1916 £9,472, for 1917 £22,191. They could not hope to continue to progress at that rate, but it was significant that the sales showed a continuous increase. The increased profits were not due to profiteering, but to natural growth of a new industry. The results had been achieved despite all the restrictions with which business was hampered to-day. The workers in the Stroud Valley were of a fine type, and their relations with them had always been of the most excellent nature, due in a large measure to the wise and sympathetic management of Mr. Cleeve and the local managers. They were creating a strong financial position. Mr. Binnie referred to the vexed question of excess profits duty and its application to new industries. New industries would be seriously handicapped. They must either work with inadequate working capital or be considerably overcapitalised by comparison with older industries. In view of the embargo on new capital, many of them might be driven to borrowing. A duty of 50 per cent., or even 60 per cent., was tolerable, but 80 per cent. stifled new industries and penalised thrifty management. The increase was a serious mistake. Although their company was not at present seriously affected by the excess profits legislation it was desirable that directors of new industries should take every opportunity of stating their case, and he hoped that discrimination might be exercised in applying new and untried legislation to our new industries.

The A.E.G.—The prospectus has just been published in Berlin in connection with the admission to quotation on the Berlin Stock Exchange of new shares of the nominal value of £1,450,000, which were decided to be issued in December, 1915, so as to permit of an interchange of shares with the company's subsidiary, the Berlin Electricity Works Co. Since then (July, 1917), a further emission of nominally £800,000 has been made by the A.E.G., and been taken over by the same company, which in exchange transferred shares in the Electro Works Co. to the A.E.G., which, in turn, as previously reported, has assigned these and other interests in the Electro Works Co. to the Imperial Government. At present the share capital of the A.E.G. stands at £10,000,000, the reserve funds are stated to amount to £4,650,000, and the loans of the 4, 4½, and 5 per cent. types which are still unredeemed total £5,300,000. The investment portfolio is represented by £2,819,000, and includes £980,000 in war loans and Government bonds, £265,000 in shares of branch companies, £625,000 in shares in A.E.G. sale companies, £477,000 in book value of 14,510,000 fcs. of shares in the Zurich Bank for Electrical Undertakings, and £362,000 in shares of the Felten & Guilleaume Co. The number of workers employed by the A.E.G. on July 1st, 1917, is stated to have been 79,298.

North Metropolitan Electric Power Supply Co.—An extraordinary general meeting of this company was held last week, when, according to the *Morning Post*, a resolution was passed to the effect that the amount which the company were authorised to borrow on debenture or mortgage of the undertaking, a sum not exceeding the nominal amount (inclusive of bonus) of £13,333 be raised by the issue at such price, and to such persons, as the directors might determine of further mortgages in the like form and on the like terms and conditions as, and ranking *pari passu* with, the existing mortgages. Mr. E. Garcke, who presided, explained that the object of the resolution was to enable the directors to provide security to be deposited with the Treasury in respect of loans obtained with the concurrence of the Ministry of Munitions for the purpose of carrying out extensions of cables and for other works to enable supplies of energy to be given for munition manufactures and other war purposes. The resolution was carried.

Claud Hamilton, Ltd.—The report for the year ended April 30th last states that the balance at credit of profit and loss account, after writing off the usual depreciation, is £10,669. Deducting from this the preference dividend, there is left for disposal a balance of £9,919. The directors recommend a dividend of 7½ per cent. and a bonus of 2½ per cent., less tax, on the ordinary shares; writing down investments, £500; placing to credit of a dividend equalisation account £2,000; and carrying forward the balance of £5,169.—*Financial Times.*

Stock Exchange Notice.—Application has been made to the Committee to allow the following to be quoted in the official list:—

Dick, Kerr & Co., Ltd.—Further issue of 40,000 ordinary shares of £1 each, fully paid, Nos. 260,001 to 300,000; and 45,000 six per cent. cumulative preference shares of £1 each, fully paid, Nos. 305,001 to 350,000.

Anglo-American Telegraph Co., Ltd.—Interim dividend for the quarter ended September 30th, 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock, less income-tax.

West India & Panama Telegraph Co., Ltd. — Interim dividends for half-year ended June, 1917:—6s. on the first and second preference shares, 6d. per share on the ordinary, free of tax.

Western Telegraph Co., Ltd.—Dividend, 3s. per share, and a bonus of 4s. per share, both free of tax, making the total for the year ended at June, 1917, 8 per cent.

Babcock & Wilcox, Ltd.—Interim dividend, 6 per cent.

STOCKS AND SHARES.

Tuesday Evening.

The strength which has prevailed amongst gilt-edged stocks gives no indication of abatement, and the inauguration of another thrift campaign will have the effect of giving a fillip to the issue of National War Bonds. This has an effect upon other gilt-edged stocks, and the Consol market is good throughout, reflecting firmness on such issues as industrial debenture stocks, and the best class preference shares. The discussion that has arisen with regard to the possibility of a levy on capital is not affecting Stock Exchange markets in any way, but the prospects which are opened in this direction are arousing a good deal of attention. They make, at any rate, an interesting, not to say poignant, subject for consideration.

The home railway market is but fairly well maintained. Once more the amount of public support necessary to keep things going in this section has dwindled away, and business is of a very irregular order. The Undergrounds, however, keep tolerably steady, and the advertisement which they received through moonlight nights is regarded as a somewhat grim bull point for the stocks. Underground Electric Income bonds are maintained at 84, but Metropolitans shed ¼ and Districts declined to 16. There is not much doing in the other stocks.

Activity in Marconi shares is wavering a little. One day there will be a very animated market, while on the next, business falls away to a shadow. Attention centres a good deal upon the American Marconi shares, possibly because there is more speculation in these; possibly because those who follow the market seem to think there is wider scope for capital appreciation here than there is in the other Marconi shares. The parent Marconis are 1/16 lower at 3 7/16. Americans rose to 23s. 3d., but came back again to 22s. 9d. Canadians are 11s. 9d., and Marines, which have a useful investment following, are a good spot at 2 21/32, both old and new shares. There has been a little interest taken just lately in shares of the Spanish Marconi Co., the price being about 11s. 6d.

The appetite for cable stocks is keen as ever. Easterns, Westerns, Eastern Extensions, and Globes are the four popular investments, this, of course, being due to the fact that the dividends on the quartette are paid free of income-tax. Prices are better, and once again it has to be remarked that stock is a good deal more easy to place than it is to buy. The recent reports are excellent, and have given reassurance to those who were inclined to apprehend a possible deduction of income-tax from dividend payments. At present, anyway, there seems to be little fear of such an alteration being made.

South Londons are 5s. better at 3; Bromptons reacted ¼ to 6¼. These are the only changes amongst the Home electricity shares, where the list as a whole keeps very hard. General Electric ordinary have risen to 18. British Westinghouse preference eased off to 2 15/16. Recent buyers of these shares are wanting to take their profits in the absence of any further developments—even rumour being quiet—in connection with the American interests that were recently credited with intentions to bring about some kind of working arrangement between the manufacturers in this and their own country. Edison Swan shares, however, are better. The fully-paid have gained 5s. at £2; the £3 shares rose to 21s., though at the moment they are obtainable at this price. The company's 4 per cent. debenture stock is a point up.

In the colonial and foreign group, Kalgoorlie preference have hardened to 5s. 3d., but Kalgoorlie Tramways debenture at 12¼ is lower, the price being still more or less nominal. One feature of the last few days is a persistent demand for Manila Electric Railway capital stock, on which the price has risen 4 to 70. Anglo-Argentine Trams First preference receded to 3, and Brazil Tractions remain depressed at 45. The Mexican stocks are also dull and heavy, small falls occurring in the bonds of the Tramways Co. British Columbia 4½ per cent. debenture at 51 shows a slight recovery.

Rubber shares are steady and command a good deal of support. There is a further advance amongst copper issues. The armament shares have been inactive, but iron and steel descriptions keep on rising. On the whole, the Stock Exchange gets a good deal of business these days, in spite of air raids and other impediments.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1915.	Dividend 1916.	Price Oct. 23, 1917.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	9	6¼	— ¼	£6 18 6
Charing Cross Ordinary	5	5	9	—	6 9 0
do. do. do. 4½ Pref.	4½	4½	9¾	—	6 18 4
Chelsea	4	5	9	—	5 9 1
City of London	8	8	12	—	6 2 1
do. do. 6 per cent. Pref.	6	6	10½	—	5 18 6
County of London	7	7	11	—	6 7 3
do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	7	6	5½	—	5 14 9
London Electric	3	3	1	—	Nil
do. do. 6 per cent. Pref.	6	4	8½	—	5 6 8
Metropolitan	5	5	8¾	—	4 12 4
do. 4½ per cent. Pref.	4½	4½	8¾	—	7 4 0
St. James' and Pall Mall	8	8	7	—	5 14 6
South London	6	5	8	+ ¼	6 12 4
South Metropolitan Pref.	7	7	21/6	—	6 10 6
Westminster Ordinary	7	7	6¾	—	5 3 3

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	6	6	99	—	6 1 5
do. Def.	33/6	1½	28½	—	6 0 0
Chile Telephone	8	8	7⅞	—	5 11 4
Cuba Sub. Ord.	5	5	6¾	—	5 14 3
Eastern Extension	8	8	14⅞	+ ¼	*5 7 7
Eastern Tel. Ord.	8	8	149½	+1	*5 7 0
Globe Tel. and T. Ord.	7	7	18½	+ ¼	*5 5 8
do. Pref.	6	6	103	—	5 15 8
Great Northern Tel.	23	24	89	—	6 0 1
Indo-European	13	13	53½	—	6 1 6
Marconi	16	15	3 3/16	+ 1/16	4 7 3
Oriental Telephone Ord.	10	10	3 1/16	—	3 2 6
United R. Plate Tel.	8	8	6 3/16	— 1/16	*5 16 4
West India and Pan.	6d.	6d.	1¼	—	3 6 8
Western Telegraph	8	8	15	+ ½	*5 6 8

Home Rails.

Central London, Ord. Assented	4	4	60½	—	6 12 3
Metropolitan	1	1	24¼	— ¼	4 2 3
do. District	Nil	Nil	16	— ½	Nil
Underground Electric Ordinary	Nil	Nil	1¾	—	Nil
do. do. "A"	Nil	Nil	6⅜	—	Nil
do. do. Income	6	4	84	—	*4 15 3

Foreign Trams, &c.

	Dividend 1915.	Dividend 1916.			
Adelaide Sup. 6 per cent. Pref.	6	6	47	—	6 3 1
Anglo-Arg. Trams, First Pref.	5½	5½	8	— ¼	9 3 4
do. 2nd Pref.	5½	—	2½	—	—
do. 5 Deb.	5	5	67½	—	7 8 3
Brazil Tractions	4	4	45	—	—
Bombay Electric Pref.	6	6	92	—	6 4 8
British Columbia Elec. Ry. Pfce.	5	5	40½	—	12 6 10
do. do. Preferred	Nil	Nil	30	—	Nil
do. do. Deferred	Nil	Nil	27½	—	Nil
do. do. Deb.	4½	4½	51	+1	8 6 3
Mexico Trams 5 per cent. Bonds	Nil	Nil	45½	—1	Nil
do. 6 per cent. Bonds	Nil	Nil	59	—1	Nil
Mexican Light Common	Nil	Nil	12½	—	Nil
do. Pref.	Nil	Nil	35	—	Nil
do. 1st Bonds	Nil	Nil	45½	—	—

Manufacturing Companies.

Babcock & Wilcox	15	15	31	—	4 12 4
British Aluminium Ord.	7	10	13	—	6 8 1
British Insulated Ord.	17½	20	147	—	6 15 7
British Westinghouse Pref.	7½	7½	2⅞	— 1/16	5 2 0
Callenders	20	20	144	—	6 18 0
do. 5 Pref.	5	5	4½	—	6 1 8
Castner-Kellner	22	22	3 3/16	—	6 8 0
Edison Swan, fully paid	—	—	2	+ ¼	Nil
do. do. 4 per cent. Deb.	4	4	75½	+1	5 8 10
Electric Construction	7½	7½	1	—	7 10 0
Gen. Elec. Pref.	6	6	10½	—	5 14 3
do. Ord.	19	10	18	+ ½	5 13 0
Hepbey	25	25	153	—	7 16 3
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	12	13	—	*7 3 15
Telegraph Con.	20	20	40	—	*8 0 6

*Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, October 24th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
c Ammoniac Sal	per ton	£78	..
a Ammonia, Muriate (large crystal)	,,	£54	..
a Bisulphide of Carbon	,,	£38	..
a Borax	,,	£39	..
a Copper Sulphate	,,	£63	£1 dec.
a Potash, Chlorate	per lb.	2/6	..
a ,, Perchlorate	,,	2/-	..
a Shellac	per cwt.	£12 10	..
a Sulphate of Magnesia	per ton	£16	..
a Sulphur, Sublimed Flowers	,,	£35	..
a ,, Lump	,,	£15	..
a Soda, Chlorate	per lb.	10½d.	..
a ,, Crystals	per ton	120/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c ,, Tubes (solid drawn)	,,	..	..
c ,, Wire, basis	,,	..	..
c Copper Tubes (solid drawn)	,,	1/6½ to 1/7	..
g ,, Bars (best selected)	per ton	£150	£1 dec.
g ,, Sheet	,,	£150	£1 dec.
g ,, Rod	,,	£150	£1 dec.
d ,, (Electrolytic) Bars	,,	£125	..
d ,, ,, Sheets	,,	£133	..
d ,, ,, Wire Rods	,,	£124	..
d ,, ,, H.C. Wire	per lb.	1/8½	..
f Ebonite Rod	,,	3/-	..
f ,, Sheet	,,	2/6	..
n German Silver Wire	,,	2/8	..
h Gutta-percha, fine	,,	6/10	..
h India-rubber, Para fine	,,	2/5½	½d. inc.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£42	..
g Lead, English Pig	,,	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	6d. to 2/-	..
e ,, ,, ,, medium	,,	2/6 to 6/-	..
e ,, ,, ,, large	,,	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/6½	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	,,	..	..
n ,, Wire, Nos. 1 to 16	per lb.	2/6	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Supplies for German Central Stations.—According to *E.T.Z.*, the amount of copper allowed quarterly by the German Metal Controller for the purpose of maintenance and repairs in electricity undertakings is at present from 2 to 3 kg. (4½ to 6½ lb.) per 100 KW. installed. The allowance to stations which serve only lighting networks is subject to special control. All metal thus released must be replaced by old metal or, if there is a loss in the repair job, this must be made good by metal taken from some source not already requisitioned. The central station may not claim in respect of repairs, &c., to be made in consumers' works; the latter must make their own claim. Iron and steel supplies are subject to strict control, but iron parts held in stock by central stations for running repairs and the like, may be used without a special permit. Electricity stations stand third on the "urgency list" prepared by the military authorities for the control and disposal of railway trucks. The first three items on the list are: (1) Coal, coke and briquettes. (2) Timber of every description, wood carbonisation products. (3) Constructional and working materials, tools and machinery for mines, gas and electricity works. Electricity stations have had to put up with inferior or unsuitable coal supplies and they will remain under this disadvantage. In order that they may keep their boilers in good order and obtain full rated output from them, it is recommended that they adopt forced draught, cooled grates and coal breakers. These improvements should be made forthwith in order that they may be completely available for future peak-load periods. The Electricity Administration (Elektrizitätswirtschaftsstelle) is willing to do everything in its power to assist in rapid delivery and installation of the equipment concerned.

Charge of Stealing Lamps.—According to the *Daily Chronicle*, a charge of stealing 868,000 electric bulbs, valued at £1,800, was brought at the Guildhall on Saturday against Simon Doitch, a Spitalfields electrical engineer. Accused's explanation was that he bought the lamps, but in a box under his bed the police found 5,300 bulbs, which bore the initials of the prosecutor's factory. A remand was ordered, bail in £200 being allowed.

First Aid in Factories.—The order of the Home Secretary in regard to ambulance and first aid arrangements at blast furnaces, copper mills, iron mills, foundries and metal works, comes into force on December 1st, and copies may be purchased at H.M. Stationery Office.

THE HIGH-TENSION MAGNETO.*

(*Continued from page* 382.)

The Installation and Care of a Magneto.

1. *Installation.*—Satisfactory operation of a magneto can only result if the alignment between the driving shaft and the magneto shaft be perfect. It is necessary to drive the magneto through some form of flexible coupling, and in a coupling that is used very extensively on aeroplane engines the drive is transmitted through a steel leaf spring having a total cross-section of 11 mm. ×15 mm. Provision is made for obtaining an angular adjustment of the part which grips the leaf spring, with respect to the part secured to the magneto spindle, for the purpose of timing.

This particular design of coupling is not ideal, because whilst being sufficiently flexible in a plane at right angles to the axis of rotation, to take care of rapid and cyclic variations in the driving torque, it does not allow for the alignment of the two shafts being slightly in error. Obviously, any error of this nature will bring into play large stresses which may eventually cause the magneto to function imperfectly. A large percentage of the troubles that have arisen in practice with aeroplane magnetos have been due to imperfect alignment.

The magneto manufacturer is very careful in machining the base to ensure that the distance between the bottom of the base and the axis of the spindle conforms with extremely fine limits of accuracy. For example, this distance in the type A.8.S. magneto is nominally 50 mm., the limits being plus 0 mm. and minus 0.05 mm., giving a tolerance of 0.05 mm.

The author doubts whether engine builders are working to such fine limits as these in milling the platform to which the magneto is secured, and, in fact, it is a very difficult matter for them to do so. Some improvement is therefore to be looked for in the direction of devising some method of fixing that will simplify the machining problem. The use of a curved base plate on the magneto is a possible solution, because this enables the engine builder to machine the surfaces requiring alignment at a single boring operation, instead of having to perform two distinct boring and milling operations.

The curved form of base is used by the S.E.V. Co., of Paris, on one of their rotating armature type six-cylinder magnetos. With this arrangement dowel pins are used in the base for location purposes, the magneto itself being secured by some form of clamping device. This would seem to be an eminently sound arrangement.

Even when fixing screws are used in the base, it is customary to employ a strap which completely embraces the magnets. These straps are usually made of steel, and tests carried out on a type A.8.S. magneto have shown that the shunting of the magnet flux resulting therefrom amounts to about 6 per cent. This means approximately a 12 per cent. loss in the energy output of the magneto—an amount not to be overlooked. It is, therefore, recommended that the straps be made of phosphor bronze, and steps are now being taken to make this change.

2. *Timing.*—It is, of course, essential that when installing a magneto the adjustment of the coupling should be carefully made to give what is termed the correct "timing." In other words, when the contacts are just on the point of separating—as determined by the indication of a battery and bell connected in parallel with them—the relation of the driving shaft to the magneto shaft must be such that the piston in the cylinder to be fired is some definite distance from the top of its stroke. When the magneto is provided with variable ignition, this adjustment is made with the timing lever fully advanced. Usually, an aeroplane magneto is timed so that each cylinder is fired when the crank is about 30 deg. behind the dead-centre position.

In the type A.8.S. magneto the operation of timing is facilitated by the introduction of locking holes in the distributor brush gear wheel and distributor end plate, so that a pin inserted in the gear wheel can lock the sleeve inductor in the correct position. The pin can only be inserted after the distributor is removed, and likewise the pin must be withdrawn before the distributor can be replaced. This ensures that the magneto is not run with the locking pin inadvertently left in place.

3. *Setting of Distributor Brush.*—When the contacts are on the point of separating and the high-tension discharge is about to begin, the carbon brush (or metal brush in the type A.8.S. magneto) should overlap the distributor segment to the extent of about two-thirds of its contact surface. In the rotating armature type magneto the desired relation between brush and segment can be easily achieved by altering the meshing of the distributor brush gear wheel with the full-speed wheel on the armature shaft. Generally speaking, the correct meshing is indicated by the magneto manufacturer, who spot-marks two teeth on the brush gear wheel and one tooth on the other wheel. When the armature is in some definite position the latter tooth should mesh between the two former teeth.

In the type A.8.S. magneto the relation of brush to segment can only be altered by displacing the brush holder mounting with respect to the gear wheel to which it is secured. A change in the meshing of the two gear wheels is not permissible.

4. *Care of Distributor and Brush.*—The distributor and brush are vital parts of any magneto, and in overhauling they should be subjected to very careful treatment. The brush track of the distributor should be kept clean and polished. Any appreciable carbon deposit can be removed by cleaning the track with a cloth soaked in petrol, but if the segments protrude even by the smallest amount, it is necessary to have the track machined. If the distributor is made of an entirely satisfactory insulating material, trouble of this nature will not be experienced, because there will be no tendency for the insulation to shrink away from the metal during the life of the distributor.

For the best results to be secured, it is necessary to use a very hard grade of carbon brush, which should be properly bedded and polished. The spring tension should not be excessive, and both brush and spring should be perfectly free to move in a radial direction. There should be no signs of binding in the brush holder. In certain quarters a carbon brush having a highly-polished contact face is looked upon with suspicion, and in consequence it is the practice to remove the polished surface by the careful application of a file! This is a most pernicious habit, and cannot be condemned too strongly.

Experience has shown that to secure freedom from what is called "tracking" of the distributor it is very necessary to use a carbon brush that will readily take a high polish. The polished skin on the face of the brush is a desirable thing, and, when working in conjunction with a distributor made of suitable material, and having a polished brush track, there is no likelihood of "tracking."

5. *Contact Breaker.*—The satisfactory operation of any magneto is to a very large extent dependent upon the platinum contact breaker points being correctly adjusted. In the type A.8.S. magneto the maximum gap between the contact points, which are made slightly convex, should be .012 in. In rotating armature type magnetos the gap usually worked to is .015 in., and, generally speaking, a magneto that has to operate at very high speeds—that is, one which has to give a large number of sparks per minute, as in the case of a 12-cylinder magneto—should work with a smaller gap than one that has not to perform such strenuous duties. Great care should be exercised to prevent oil getting on to the contacts, because this will set up sparking, in consequence of the large resistance interposed between the contact faces, and carbonisation of the oil will result, which will greatly interfere with the satisfactory running of the machine. The contacts should therefore be kept perfectly clean, and this can be readily done by using a fine emery cloth. A file should not be employed under any circumstances whatever.

6. *Lubrication.*—As it is standard practice to use ball bearings in every type of high-tension magneto, very little lubrication is necessary, and special attention should be given to this point by all those who are entrusted with the care of magnetos fitted to aeroplanes or used for other purposes. Over-lubrication is, in fact, more likely to produce injurious results than too little lubrication, because the oil wells are likely to become flooded, and oil will possibly find its way into the distributor and contact breaker housing. Taking the type A.8.S. magneto, for example, six drops of oil in each oil well every 12 hours of running will be quite sufficient.

The Problem of Engine Starting.

The starting characteristics of the petrol motor are inherently bad. With other prime movers, such as the steam engine or turbine, motion results as soon as steam is allowed to enter the machine, whilst the ordinary electric motor can be started by the simple closing of a switch.

There are, fundamentally, only three methods of starting a petrol motor, neither of which is ideal:—

(*a*) To rotate the crank shaft slowly by applying a driving torque, until the cylinders are filled with an explosive mixture and the magneto is running at a sufficiently high speed to ensure satisfactory ignition. The driving torque may be produced either by hand rotation or by driving the crank shaft through gearing with an electric motor fed from a battery.

(*b*) To introduce compressed air into the cylinders so that the necessary driving torque is transmitted to the crank shaft through the medium of the pistons and cylinders. Starting is then effected as under (*a*).

(*c*) To fill one particular cylinder with an explosive mixture by hand rotation, or in some other way, and, whilst the crank shaft is stationary, cause an igniting spark to occur in this cylinder, using for this specific purpose a hand-operated auxiliary magneto co-operating with the main magneto. The main magneto may itself be adapted for producing this spark, while stationary, if suitable auxiliary apparatus be provided.

Method (*a*), using an electric motor, is generally adopted in America at the present time for motor-cars. It is also employed very considerably in this country for the same purpose. The method is far from perfect, chiefly for the reason that the torque required to start the engine is enormous for the size of motor that is generally installed.

* Abstract of paper read by Mr. A. P. Young, A.M.I.E.E., before the Aeronautical Society.

The consequence is that at the instant when the switch is closed, the momentary rush of current reaches an extraordinarily high value—about 200 amps. for a 12-volt battery—when considered in relation to the capacity of the battery that has to supply it. Such treatment means that the battery very rapidly wears out and becomes useless.

This method has been tried on aeroplanes, but with what success the author cannot say. Fundamentally, it does not seem to be a method particularly suited to the requirements of the case, unless by very special attention to the design of the electric motor it is possible to reduce the weight to an extremely small figure.

Method (*b*) has also been tried on aeroplanes, but here, again, possibly on account of the increased weight of the compressed-air bottles which have to be carried, the method does not seem to have come into general use.

Method (*c*) appears to have met with the greatest success, and it is the method generally used at the present time on aeroplanes. So that this method can be applied, it is necessary to slightly modify the distributor brush holder, by adding what is termed a "trailing point." This is merely a nickel point which is moulded in the insulator so that the angle between it and the axis of the distributor brush is something of the order of 30 deg. This point is connected to a brass ring on the front of the brush holder moulding, and an extra terminal on the distributor is connected to an additional carbon brush which is in contact with the ring.

The hand-starting magneto—which is a small rotating armature type machine driven through gearing by hand—is connected to the extra distributor terminal, so that when it is operated the trailing point is maintained at a high potential. This means that when the trailing point comes in close proximity to the trailing edge of the distributor segment current will flow from the point to the segment through the air, and thence to the electrodes of the spark plug in the cylinder that is filled with an explosive mixture.

Owing to the angular displacement between the trailing point and the main brush, the piston in the cylinder under consideration will always be near the dead-centre position when the conditions as previously described obtain. The piston should, therefore, receive a forward impulse when the spark occurs, and this should be followed by other impulses in proper sequence, until a speed is reached at which the ordinary magneto is capable of performing its proper functions.

The hand-starting magnetos that have been developed in this country differ from the standard Bosch machine in that no high-tension switch is provided for the purpose of breaking the connections to the main magneto so long as the starting magneto is being operated. It is true that the introduction of such a device complicates the wiring, because it means that the high-tension lead from the armature of the main magneto has to be brought to a distributor terminal on the starting magneto, and another lead run between some other terminal on this distributor to the rotating brush on the main magneto.

Against all this we have to consider that the use of a high-tension switch absolutely prevents the main magneto coming into action until the starting magneto is stopped. Without the high-tension switch the main magneto will come into action at extremely low speeds, so that to prevent backfires it is necessary to retard the ignition during the starting period. The other scheme eliminates this necessity, because with fixed ignition on the main magneto it should be possible to take the engine up to a sufficiently high speed with the hand starter to ensure that when the main magneto comes into operation the timing of the spark will not be too far advanced.

It is perhaps not out of place to refer to the method of starting adopted on the 200-H.P. Maybach engine fitted to German airships brought down in this country, as described in *The Autocar* for December 16th, 1916. This type of engine has six cylinders, two-point ignition being provided. Two Bosch Z.H.6 magnetos—a new type of rotating armature magneto evidently developed since the outbreak of war—one of which is fitted with a trailing point, are provided. The hand starter is coupled up to the magneto with trailing point in the ordinary way.

A special method is adopted for filling the cylinder with an explosive mixture. By means of a lever and cam shaft all the valve tappets, inlet and exhaust, are lifted off their cams. At the same time the lever actuates other levers which close the exhaust passage to the silencer, by partially rotating the water-cooled barrel valve in the exhaust manifold. The exhaust ports and the outlet in the exhaust manifold are thus put in communication with a secondary outlet pipe that leads to a large suction hand pump, by means of which gas is sucked into the cylinders from the two carburetters through all the inlet valves. When this has been done the lever arm previously referred to is returned to its normal position. This operation opens the exhaust outlet to the silencer in the normal running position and closes the pipe leading to the suction pump. The hand starter is finally turned and the engine begins to rotate.

It is interesting to note that the angle between the trailing point and the centre of the distributor brush on the Bosch Z.H.6 magneto is 42 deg. On the type A.8.S. magneto fitted with trailing point this angle is, as already stated, 30 deg.

(*To be continued.*)

BRITISH AND AMERICAN ELECTRICAL TRADE WITH AUSTRALIA.

A FORTNIGHT ago we published (Elec. Rev., p. 348), under the title "'Supertax' on British Trade with Australia," a criticism offered by the *Australian Statesman* of the action of the Australian Customs Authorities in adding 10 per cent. to British machinery invoice figures. We have now received the following copy of a letter written to the *Melbourne Age* by Mr. R. F. Butler, the local secretary of the B.E.A.M.A., which, in view of its interest, we quote in full:—

"The Senate last evening (August 10th) passed a resolution for the appointment of an official representative in Washington. The debate indicates that the function of this official representative will be to increase Australian trade with America, and recent cablegrams show that the appointment will be welcomed by the United States Government. The cordiality with which the proposed appointment has been received in the United States conveys the impression that the United States see, in the appointment, a possibility of increasing very materially its trade with Australia. It would be interesting to know whether the idea of making this appointment originated in Australia or in the minds of American representatives, either in the United States or in Australia. Anyone who has followed the development of this matter up to date cannot get away from the impression that its ready approval by the United States trade authorities is inspired by the idea that through this channel the trade of the United States with this country will be materially increased. We can hardly think that a producing country like the United States is hankering after the products of Australia to such an extent that it would invite or, at any rate, receive so warmly the appointment of an Australian representative merely for the purpose of promoting the exportation of Australian products to America, but rather that a country producing much the same commodities as Australia is animated more by the desire to use such a special representative as a means of increasing its export trade to Australia.

"For a considerable time this country has been courted in trade matters by America, who, naturally, has been taking advantage of the difficulties which British trade has experienced, due to war conditions, to extend her export trade to Australia. Australia appears now to be on the point of yielding to American persuasion, forgetting, apparently, the enormous debt she owes to Great Britain for her security and existence as a nation and for support in the whole of her financial transactions.

"In the business of exporting goods to Australia, America is a direct competitor of the United Kingdom, and in spite of our obligations to the mother country the Commonwealth Department of Trade and Customs has for some considerable time been increasing Great Britain's difficulties in carrying on her export trade with this country by 'loading' British invoices. Taking advantage of the increase which has taken place in the cost of manufacturing in Great Britain, particularly in dynamo-electric machinery, the Customs authorities have issued a ruling that all invoices for dynamo-electric machinery imported from the United Kingdom shall be loaded 10 per cent., with a net result that British manufacturers have to face a 10 per cent. increase in the duty which they have to pay, and which, in some cases, notably metal-filament lamps, is not imposed on, at least, one neutral country.

"The Customs Department may have legal justification, in view of the wording of the Customs Act, for loading invoices covering the importation of material which was contracted for before the war, but, at the present moment, if a British firm received an order for dynamo-electric machinery the invoice value is, for duty purposes, increased 10 per cent. by the Customs Department, notwithstanding the fact that such an invoice carries on the face of it the declaration required by the Customs as to its fair value, and independent altogether of any inquiries as to whether or not the particular invoice gives the fair market value in Great Britain. In this particular way the present administration of the Customs Act defeats the declared intention of this country to give preference to British material. To quote one instance: A 50-C.P. lamp imported from Holland pays in round figures 2½d. duty, while a similar lamp imported from Great Britain pays 5d. duty. It would be interesting to ascertain from the Customs Department whether, for example, they have in Holland at the present moment officers to ascertain what is a fair selling value of lamps in Holland, or whether they have officers in Sweden to ascertain the fair selling value of electrical material manufactured in Sweden and exported to this country.

"The whole attitude of the Customs Department, and the recent developments with regard to the appointment of a special representative in the United States, leaves a somewhat unpleasant impression in the minds of British manufacturers that Australia cares nothing for the success of British trade with this country, and that her attitude is not only indifferent, but is actually antagonistic to the support of British industry.

"Is it too much to ask that, while Australia enjoys its security, and while Great Britain is absorbed in the present Herculean struggle with all her energy, Australia should not only support British trade in materials which cannot at present be manufactured in Australia, but should refrain from imposing additional burdens on the already hard-pressed

British manufacturer, and should also refrain from taking steps which will make it more difficult after the war for Great Britain to regain that portion of Australian trade to which, in common gratitude, she is entitled?"

The *Melbourne Age* makes the following comment on the matter:—

"Some light was thrown in the House of Representatives on the practice of the Customs Department in 'loading' invoices of dynamo-electric machinery imported into Australia from the United Kingdom. The Minister of Customs, in reply to Mr. Kelly (N.S.W.), said invoices were loaded by varying percentages, which were dependent upon the extent of the difference between the export price charged to the Australian importer and the home-consumption price charged to British buyers, which was the statutory basis of duty. This was done because it was found that manufacturers allowed buyers for export lower prices than were given to buyers for home consumption. These loadings had been imposed upon the invoice values of certain British firms, as far back as 1905, but the loadings now in force had, for the most part, been imposed since 1915. A similar practice had been followed in respect to certain American firms since 1907. The invoice values of metal-filament lamps from the United Kingdom were 'loaded,' but not of similar goods from Holland, because the prices charged for export by the Dutch manufacturer were the same as were charged for home consumption. Dutch lamps were accompanied by a certificate of origin, issued by the British Consul-General."

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

B.T.H. Oil-break Switches.

The British Thomson-Houston Co., of Rugby, has recently issued two new lists, Nos. 4153 and 4155, dealing with oil-break switches, types O, form C, and O, form E, respectively. The former type, illustrated in fig. 1, is suitable for circuits up to 300 amps.

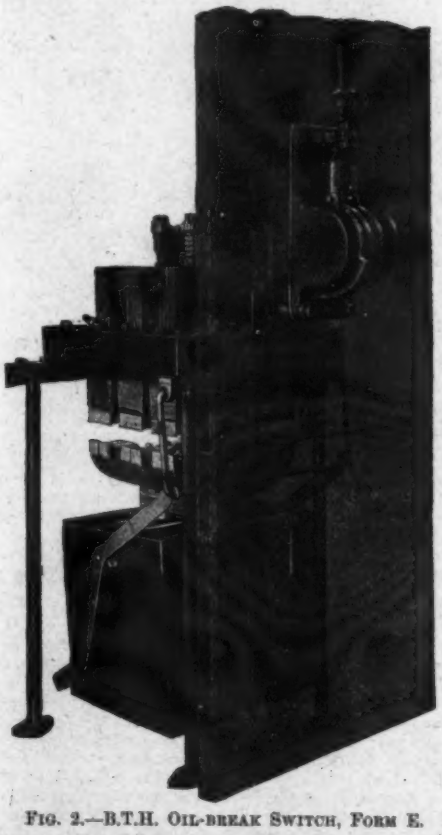


Fig. 2.—B.T.H. Oil-break Switch, Form E.

at 3,300 volts, while the latter type (see fig. 2) is designed for use on heavy A.C. circuits up to 650 volts with ratings of 2,000 and 3,500 amps. at 50 cycles or less.

In the former type, standard switches can be supplied in single, double or triple-pole non-automatic and automatic patterns suitable for switchboard mounting, also in single-pole automatic patterns for wall mounting.

These switches are of the free-handle type, and open by gravity when the tripping device operates; the switch motion is accelerated by the aid of springs, and a double break is obtained.

The oil vessel, trip coils, and operating mechanism are supported by a common frame; the switches can be provided with overload and low-voltage release, and in connection with the former a time-lag device of the oil dash-pot type can be supplied.

The form E switch is of heavier construction; the oil-tank contacts and operating mechanism are mounted on an impregnated

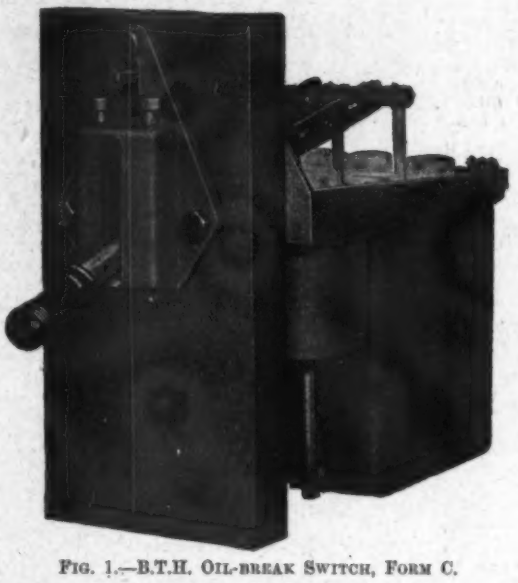


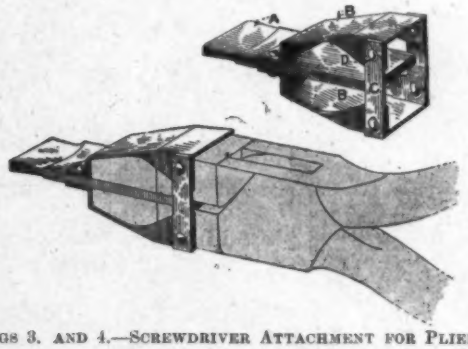
Fig. 1.—B.T.H. Oil-break Switch, Form C.

slate base, as shown in fig. 2; contact is made by laminated brushes bearing on solid copper blocks, and the brushes have renewable sparking contacts for the protection of the main contacts. Various combinations of trip coils can be provided, and in such cases B.T.H. time-limit fuses are fitted, giving a wide range of adjustment for time and current. The switch-operating mechanism is of the free-handle type, and auxiliary indicating circuits fitted with bell or lamp can be installed.

Screwdriver Attachment for Cutting Pliers.

Since pliers and screwdrivers are the tools most frequently used by the electrician, they should be in such a form that they can be easily carried around. Pliers with a screwdriver forged at the end of one of the handles are common, but the screwdriver is unhandy and is seldom used.

After considerable experimenting, the screwdriver attachment shown in the illustrations was developed and has proved very useful.



Figs 3. and 4.—Screwdriver Attachment for Pliers.

In fig. 3, A is made of tool-steel and hardened. The jaws B are bent from $\frac{1}{16}$-in. soft sheet iron and held together by the two straps C, and rivets D. Dimensions cannot be given, as curves and shapes change in accordance with the shape of the pliers used. The form is obtained by bending the sheet iron round the pliers and riveting it to the tool-steel blade A. The device is so small that it can be easily carried in the vest pocket. Fig. 4 shows the screwdriver attachment in place ready for use.—M. P. Bertrande, in *Power*.

Drawn-wire Lamps in Austria.—The patent dispute concerning the rights in drawn-tungsten filaments is reported to have been settled in Austria, where the Patent Office has decided in favour of the A.E.G. and its allied companies in this particular matter.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

RUSSIA.—A Decree of the Provisional Government was promulgated on August 23rd putting into force the Decree prohibiting the importation of all goods except under licence —see the ELECTRICAL REVIEW for September 21st. The prohibition is stated to be applicable to imports by sea (all frontiers), *viâ* the Russo-Finnish frontier, *viâ* the station of Manchuria on the Asiatic frontier, and covers both ordinary shipments and goods sent by parcel post. In view, however, of the fact that it is practically impossible to send goods to Russia except by arrangement with the Commission Internationale de Ravitaillement, the above-mentioned prohibition is of little real interest to shippers. Goods shipped under permit issued by the Commission require no further licence.

SWITZERLAND.—A Federal Decree has been issued consolidating and extending the Swiss prohibitions of export. The effect of the measure is to prohibit the export of goods of all kinds with the exception of a specified list, which includes china insulators and electric arc lamps. Dynamo-electric machines, electrical transformers, induction coils, and high-tension coils for dynamos are among the prohibited goods.

TUNIS.—A Decree, dated July 31st, has been promulgated which imposes on the importation of goods into Tunis restrictions similar to those imposed in France by the Decree of July 8th—see the ELECTRICAL REVIEW of October 5th.

MEXICO.—The retirement of the paper pesos, known as *infalsificables*, by means of a surtax on imports and exports, and on the production taxes on petroleum and metals, has been decreed. As from April 1st last, all import and export duties, and also the stamp tax on metals, &c., were to be subject to a surcharge of one dollar *infalsificable* paper for each gold dollar or fraction thereof of the amount payable.

COSTA RICA.—A Decree has been issued by Congress establishing export duties, payable in American gold, on certain articles, including manganese ore, the duty on which is fixed at 6 per cent. *ad val.*, and rubber, the duty on which is 10 per cent. *ad val.* These export taxes are to be paid in bills of exchange drawn on the place to which the goods are destined.

REPUBLIC OF COLOMBIA.—Certain modifications of the import Tariff of the Republic have been made by a recent Law. Steam or electric motors and accessories, iron or steel towers, steel cables, rails, and accessories of iron—all for aerial lines—are now admitted free of duty. Gauze or netting of copper wire is now dutiable at the rate of 6 cents (about 3d.) per kilog.

CHILE.—As from April 12th, export duties are now payable as follows:—60 per cent. in notes, with the corresponding surcharge, as noted in the ELECTRICAL REVIEW of August 24th,; 30 per cent. in drafts on London at 90 days' sight, the amount in drafts to be paid for each gold peso to be determined according to the average exchange value of drafts—to be ascertained weekly; and the remaining 10 per cent. in national gold coin.

ECUADOR.—A recent Presidential Decree provides that samples having a commercial value, introduced by commercial travellers, are granted temporary duty-free admission, under bond for re-exportation within 120 days. A slight modification has also been made in the conditions under which duty-free admission is accorded to commercial advertising matter in the form of sheets, pamphlets, or cards, and objects which are not and do not contain articles for sale. These must now bear an inscription, in letters of a size not less than half a centimetre, that the articles are intended for gratuitous distribution (*"que estan destinados para obsequios"*).

ARGENTINE REPUBLIC.—The Argentine Budget Bill for 1918, which has recently been submitted to Congress, contains a clause which provides that the tariff valuations shall be increased by 10 per cent. in respect of goods which, under the Customs Laws, have to pay duty on their weight plus that of the immediate wrappings and packings, in cases where such goods are imported into the Republic without such internal wrappings and packings.

It is also proposed that, from September 1st, 1917, to the end of the year 1918, all goods exported from the Republic shall pay an export duty at the rate of 2 per cent. *ad val.*, except certain articles which are to pay specific duties. Products the export of which can only be effected under licence are to pay a tax of 20 per cent. *ad val.* The export duties are to be payable in gold currency.

Electric Steel in Italy.—The Società delle Ferriere di S. Giovanni Valdarno inaugurated, on August 7th, the first of the Siemens-Martin furnaces which it has decided to lay down to complete its projected equipment and to assist in developing its lignite mines. The new steel furnace will work with electrical energy supplied by the company's own works, which utilise lignite as fuel.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford

14,538. "Machine for generation of electric currents." A. YOUNG. October 8th.

14,557. "Electric snap switches." HART & HEGEMAN MANUFACTURING Co. AND J. S. WITHERS. October 8th.

14,560. "Circuit-breakers for ignition apparatus." REMY ELECTRIC Co. October 8th. (U.S.A., November 10th, 1916.)

14,561. "Magnet coil windings for dynamo-electric machines, transformers, &c." LANCASHIRE DYNAMO & MOTOR CO. AND H. B. WHITMORE. October 8th.

14,588. "Tool for clinching terminals for electric, &c., couplings." ROSS, COURTNEY & Co. AND J. A. ROSS. October 9th.

14,597. "Signalling systems." BRITISH THOMSON-HOUSTON Co (General Electric Co., U.S.A.). October 9th.

14,598. "Alternating-current generators." T. F. WALL. October 9th.

14,607. "Cathodes." A. A. LOCKWOOD. October 9th.

14,613. "Electric rheostat or resistance indicators for switchboards, &c." C. R. ISENTHAL. October 9th.

14,622. "Detecting low-frequency impulses." R. A. FESSENDEN. October 9th. (U.S.A., May 21st.)

14,652. "Amplification of small currents." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). October 10th.

14,653. "Leading-in wires for electric incandescent lamps, &c." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). October 10th.

14,654. "Electrical circuit-breaker." W. H. ILLINGWORTH. October 10th.

14,664. "Electrically-heated clothing for aviators, &c." A. A. LEMERCIER. October 10th.

14,723. "Electric switches." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). October 11th.

14,727. "Dynamo-electric machines." H. CHITTY. October 11th.

14,738. "Portable transformers." JOHNSON & PHILLIPS AND W. C. KENNETT. October 11th.

14,742. "Fitting safety fuses in electrical circuits." A. SMITH. October 11th.

14,748. "Electrically-heated apparatus." J. KEIL & A. A. STOW. October 11th.

14,749. "Apparatus for electro-deposition." S. O. COWPER-COLES. October 11th.

14,750. "Coupling devices for electric cables." C. W. DURNFORD & SUBMERSIBLE AND J.L. MOTORS, LTD. October 11th.

14,753. "Ignition devices for explosion engines." R. HADDAN & MOTOR COMPONENTS, LTD. October 11th.

14,759. "Electric junction boxes." CALLENDER'S CABLE & CONSTRUCTION Co. & F. MOOR. October 12th.

14,796. "Directive wireless telegraphy." E. R. CLARKE. October 12th.

14,798 & 14,799. "Ignition apparatus for internal-combustion engines." G. A. LISTER, M.L. MAGNETO SYNDICATE, & E. A. WATSON. October 12th.

14,814. "Electric condensers." F. R. SIMMS & SIMMS MOTOR UNITS, LTD. October 12th.

14,824. "Telegraphic apparatus." C. DOMANICO. October 12th.

14,838. "Method of construction of electric furnaces of the heated-coil type." J. E. P. KIEVITS & KYNOCH, LTD. October 13th.

14,839. "Portable electric battery lamps." A. M. DUNLOP. October 13th.

14,858. "Auxiliary ignition attachment." P. HAY. October 13th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

8,618. ANTI-RHEUMATIC OR ELECTRIC KNITTING NEEDLES. E. T. Bartlett and G. M. Simpson. June 19th, 1916. (109,628.)

11,730. ADVERTISING AND OTHER DEVICES PROVIDED WITH PARTS ADAPTED TO BE BROUGHT INTO SUCCESSIVE POSITIONS. H. K. Harris. August 18th, 1916. (109,637.) (Patent of addition not granted.)

11,844. METHOD OF PRODUCING AND CONTROLLING HIGH TEMPERATURES IN ELECTRIC FURNACES. J. J. Denton. August 21st, 1916. (109,639.)

12,781. TELEPHONE SYSTEMS. Western Electric Co. & A. E. Reinke. September 9th, 1916. (109,640.)

13,343. METHOD OF FORMING METAL ELECTRODES USED IN ELECTRIC ARC SOLDERING AND DEPOSITION OF METALS. F. H. Jones. September 20th, 1916. (109,652.)

13,939. AIRCRAFT FOR OBSERVATION AND LIKE PURPOSES. P. J. Pybus and Phœnix Manufacturing Co. September 30th, 1916. (109,672.)

14,658. PROTECTION OF ELECTRIC CABLES. F. B. Whitaker. October 16th, 1916. (109,679.)

14,885. AUTOMOBILE VEHICLES AND TRACTORS. Daimler Co., E. Boughton and H. J. Balcombe. October 19th, 1916. (109,680.)

15,350. ELECTRIC HEATING ELEMENT FOR KINDLING. R. K. Hearn. October 27th, 1916. (Addition to 4,600/15.) (109,684.)

16,814. MEANS FOR ATTACHING LAMPS TO ELECTRIC WIRING. W. W. O. Fenety. December 14th, 1915. (102,719.)

17,286. APPLIANCE FOR ATTACHING SHADES TO THE HOLDERS OF ELECTRIC LIGHT FITTINGS. J. Doble & W. Casbon. December 1st, 1916. (109,706.)

17,340. POLARISED ELECTRIC RELAYS. M. B. Rodrigeuz. December 2nd, 1916. (109,707.)

17,410. APPARATUS FOR THE TRANSMISSION OF SOUND THROUGH THE AURICULAR CAVITIES OF THROAT AND HEAD. V. Drew. December 4th, 1916. (109,708.)

17,890. MANUFACTURE OF CYLINDRICAL AND TUBULAR ARTICLES OF GLASS. D. Webb. December 13th, 1916. (109,711.)

18,609. ELECTRIC WARMING APPARATUS. H. T. Pinnock. December 29th, 1916. (109,719.)

1917.

2,794. FLUID METERS. Cutler-Hammer Manufacturing Co. March 23rd, 1916. (105,061.)

4,559. ENGINE STARTER. V. Bendix. March 29th, 1917. (109,747.)

7,973. MAGNETIC SEPARATORS. Hardy Patent Pick Co. & G. J. M. Smith. June 4th, 1917. (109,766.)

10,354. PORTABLE DRY BATTERY ELECTRIC TORCHES. M. H. Goldstone. July 18th, 1917. (Addition to 2,036/15.) (109,776.)